

The precarious political economy of cobalt: balancing prosperity, poverty, and brutality in artisanal and industrial mining in the Democratic Republic of the Congo

Article (Accepted Version)

Sovacool, Benjamin K (2019) The precarious political economy of cobalt: balancing prosperity, poverty, and brutality in artisanal and industrial mining in the Democratic Republic of the Congo. The Extractive Industries and Society. ISSN 2214-790X

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The precarious political economy of cobalt: Balancing prosperity, poverty, and brutality in artisanal and industrial mining in the Democratic Republic of the Congo

1. Introduction

The staggering rate of adoption of digital devices and electronics in our modern society has resulted in astronomical growth in critical mineral resources such as cobalt. Baldé et al. (2017) note that at the end of 2017, roughly half of the world population accessed the World Wide Web and high-speed internet, and most people have access to mobile telephone networks and services. In more concrete numbers: the world counts 7.7 billion mobile cellular subscriptions; almost half of all global households (48%) have a computer; and the value of global electronic commerce surpassed \$22 trillion in 2017. Such phones and computers, as well as other technologies such as electric vehicles, wind turbines, automobiles, lighting, solar panels, and even fuel cells and nuclear reactors, all depend on a “mineral foundation” of raw materials such as cobalt (Bazilian 2018). Indeed, ERG (2018) estimates that due to the Paris Agreement, a *50-fold* increase in electric vehicle adoption needs to occur between 2016 and 2030, reaching 100 million electric vehicles by that year. Thus, the cobalt demand in electric vehicle batteries is expected to grow by 200% between now and 2020, and again by 500% by 2025, when the battery market is expected to be worth \$100 billion (ERG 2018). For reasons such as these, Lindberg and Andersson (2019) write that cobalt is the modern-day “oil” of a low-carbon economy.

A mining boom has thus been underway for critical metals needed to manufacture such technologies. Al Barazi et al. (2017) note that already, global cobalt demand jumped from 65,000 tons in 2010 to more than 90,000 tons per year in 2015, and that the DRC was the largest producer, responsible for roughly 60% of global supply. More than 50% of the world’s cobalt goes directly into batteries for phones, computers, and electric vehicles, leading analysts to declare it the “hottest commodity” of 2017 (Nuklu et al. 2018). Industry experts expect to see 2020 demand reach 120,000 tons of cobalt production per year, and in February 2018 cobalt prices were more than 150 percent higher than the previous year (Katz-Lavigne 2019a). Moores (2018) similarly project that cobalt demand will jump from 144,000 tons in 2023 to 218,400 tons by 2028. Although non-cobalt-based rechargeable battery alternatives are being developed, and manufacturers are also trying to minimize the amount of cobalt in batteries, the implication is that demand for cobalt will rise well into the future.

But is this mining boom actually a positive development for the Congolese people? Civil society groups and the popular media in particular have published a series of reports

and articles arguing that the informal mining sector in the DRC ignores occupational safety and health standards, and violates human rights protections (Amnesty International 2016a; Amnesty International 2016b; Kara 2018; Lindberg and Andersson 2019). Does it? Furthermore, the more industrialized, large-scale mining sector has been critiqued for embracing a process of formalization that merely solidifies state control, fails to reduce poverty, breeds corruption, entrenches elitism, and in some instances perpetuates violence (Geenen 2011; Perks 2011; Geenen 2012; Verweijen 2017; Zeuner 2018; Geenen and Cuvelier 2019). Does it still?

Based on extensive and original field research in the DRC—including expert interviews, community interviews, and naturalistic observation at mining sites—this study asks: How is cobalt currently extracted in the DRC? What benefits has cobalt mining brought communities in the DRC? What risks has it created? And, critically, what policies need implemented to make mining there more equitable sustainable? It documents six interrelated benefits to cobalt mining: poverty reduction, community development, regional stability, ancillary markets, state revenue, and a strong social and cultural identity. However, it situates these alongside six serious challenges: accidents and occupational hazards, environmental pollution and degraded community health, exploitation of miners and unfair market practices, the erosion of democracy via corruption and malfeasance, displacement of indigenous peoples, and violent conflict and death. The article then draws from its empirical data to propose seven policy recommendations.

In pursuing this path, the main contribution the article intends to make is humanizing the plight of cobalt miners in the DRC, and revealing the tensions and tradeoffs associated with the recent mining boom. Nonetheless, even though its primary objective is empirical rather than conceptual, the study is novel in multiple ways. It assesses both artisanal and small-scale mining (ASM) alongside large-scale industrial mining (LSM). It examines active and inactive sites. It relies on field research and site visits to the mines themselves as well as other parts of the supply chain including trading depots and processing centers. It conducted expert interviews as well as community interviews with industrial miners, artisanal diggers, industrial and artisanal bosses, traders, refiners, crushers and sorters, and even union leaders and members of the mining police. It lastly examines the dynamics of both ASM and LSM mining in the context of the DRC, a state known for weak oversight and governance (Katz-Lavigne 2019b; Vogel 2018; Honke 2010), a place where corporate firms and mining associations operate with perhaps as much power as government actors, often placing miners

themselves at the bottom of a hierarchy of interests. This is what is meant by the framing of the study around a “precarious political economy,” where we see miners exploited by multiple actors across multiple dimensions. Furthermore, even though the study’s contribution is more confirmatory, or hypothesis confirming, than exploratory or hypothesis generating (Sovacool et al. 2018), it is hoped its data can inform others seeking to develop, synthesize, or test theories and concepts, especially those related to political economy, political ecology, and social justice.

2. Copper and cobalt mining, case study selection and research methods

To begin, it is helpful to briefly describe the political and social contours of the DRC before introducing readers to the case study locations (in the former province of Katanga) and discussing the mixed methods utilized in the study.

2.1 General background of the DRC

The DRC is large country in Central Africa, with a geographic size roughly equivalent to that of mainland Western Europe. It is the second largest country in Africa, covering more than 2.3 million square kilometers, and the twentieth most populous country in the world, with almost 80 million people (KPMG 2018). The country has been known most recently for the outbreak of Ebola in the northeast, as well as more historically-rooted rebel fighting and militant groups in the east (Beni and North Kivu), and political violence in the West. The BBC (2018) reported almost 1,150 acts of political violence that year. Despite having vast natural resources, more than half (63%) of Congolese citizens live below the national poverty line of less than \$1 per day (EITI 2019). The DRC also lacks many of the basic services found in developed countries: the access rate to clean drinking water is 26%; the completion rate to the secondary level of school is 18%; the electrification rate is 6% (KPMG 2018). The DRC has one of the highest infant/child and maternal mortality rates, one of the highest rates of malaria, and one of the highest rates of HIV/AIDS, with about 10% of the sexually active population impacted (KPMG 2018). Previous armed conflicts have displaced about 2 million people but affected 75% of the population.

2.2 Case study selection

Notwithstanding these stark challenges, the DRC was selected as a case for this study because of its abundant cobalt resources and mining activities. Cobalt is commonly mined as a byproduct of either copper or nickel mining. The DRC has some of the highest quality reserves globally, with many mines having grades above 3% compared to the global average

of 0.6 to 0.8% (KPMG 2018). The DRC leads the world in cobalt production, is the seventh largest mining producer overall (for all metals and minerals) and the 8th largest producer of copper. The World Bank (2007) estimates that the “Copperbelt area,” mostly within the former Katanga province of the DRC (See Figure 1), contains an estimated 55.5 million tons of copper and 3.6 million tons of cobalt. The DRC thus possesses roughly 34% of the world’s cobalt resources and 10% of the world’s copper resources (Crundwell et al. 2011).

Figure 1: The former Katanga Province in the Democratic Republic of the Congo



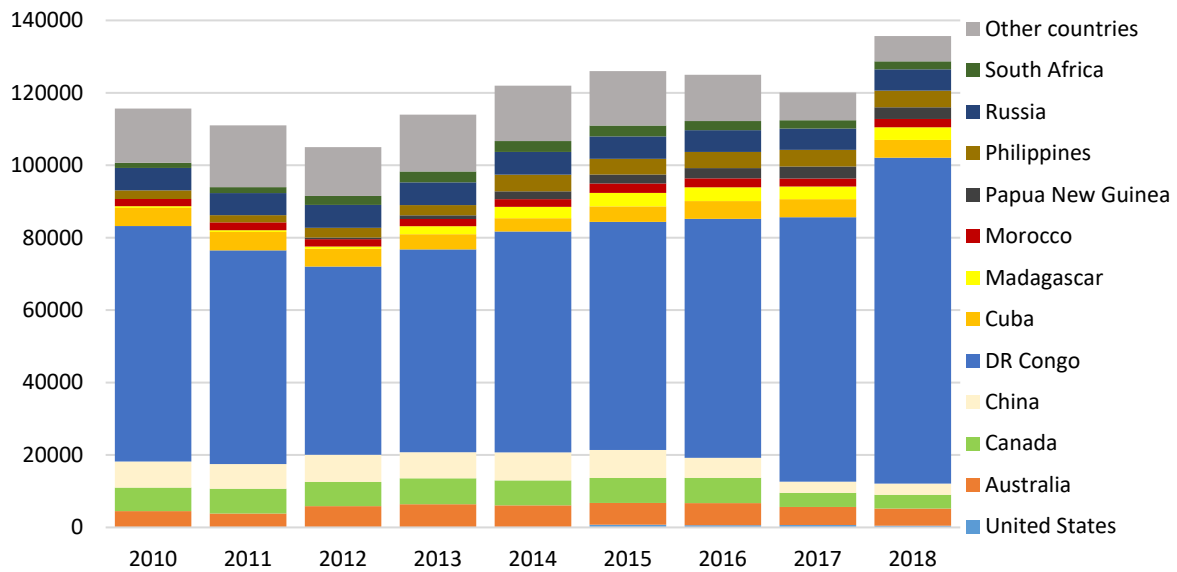


Source: Amnesty International (2016a).

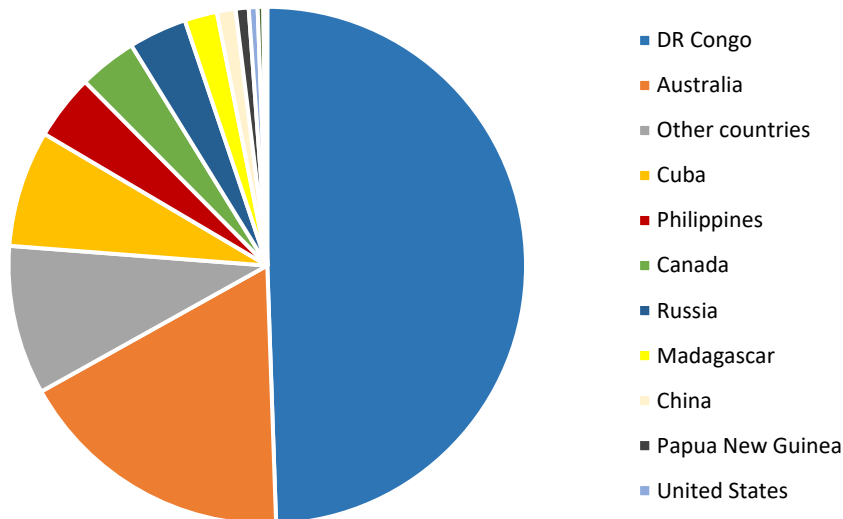
Unusually, the DRC features two separate types of exploitable cobalt resources: weathered oxide deposits near the surface, and prone to surface mining; and un-weathered sulfide deposits below the oxide deposits, at depths typically between 70 and 150 meters, prone to underground mining (Crundwell et al. 2011). This results in a fairly unusual dual resource system where natural or pure deposits of cobalt are mined alongside accessory or polluted deposits from earlier mining efforts (Cheyns et al. 2014: 313; Squadrone et al. 2016: 679). Due in part to this unique combination of reserves, the DRC dominates global cobalt production (Bazilian 2018). As Figure 2 shows, it far surpasses any other country for both cobalt mined and produced as well as estimated reserves. Rawles (2018) projects that DRC dominance will only *grow* in the future, anticipating that the country's share of global cobalt production will rise to 75% by 2021.

Figure 2: Global cobalt reserves and mine production

a. Cobalt mine production from 2010 to 2018 (in tons)



b. Estimated cobalt reserves in 2019



Source: Author, with data compiled from United States Geologic Survey 2017; Al Barazi et al. 2017; United States Geologic Survey 2019.

Because of this global dominance for cobalt, the DRC supplies metals that end up in some of the best-known digital and consumer products in the world. Amnesty International (2016a) traced cobalt trading flows from the Katanga region and found that its minerals end up in the supply chains of major transnational firms including Apple, Dell, Hewlett-Packard, Huawei, Lenovo, LG, Microsoft, Samsung, Sony, and Vodafone. DRC cobalt is also an essential part of the supply chains for manufacturers such as Daimler AG, Volkswagen, and the Chinese firm BYD.

2.3 Research design

To collect data on mining in the DRC, this study relies on a mixed methods research design involving expert interviews, community interviews, naturalistic observation and site visits, and a literature review.

The author first conducted 23 semi-structured expert research interviews in February to April 2019 at a variety of institutions involved with knowledge of mining in the DRC. This included:

- Government agencies such as the Service d'Assistance et d'Encadrement du Small Scale Mining (SAESSCAM, recently renamed SAEMAPE) and the Ministry of Mines in the DRC;
- International civil society groups such as Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the German Federal Institute for Geosciences and Natural Resources (BGR) as well as local groups such as Resource Matters and the Carter Center;
- Private sector firms and organizations including Gécamines (state-owned mining company), L'entreprise minière Congo Dongfang Mining (CDM mining), Tenke Fungurume Mining (TFM), Glencore, and Ruashi Mining;
- Academic institutions, including the Universities of Liège in Belgium, University of Groningen in the Netherlands, Colorado School of Mines in the United States, University of Bath in the United Kingdom as well as the Université de Kinshasa and the Université de Lubumbashi in the DRC.

During each interview, the author asked the following standard questions: “How would you describe the mining activities for copper and cobalt in the DRC?” “What positive benefits and negative costs associated with mining have occurred?” “Who has been the most vulnerable, or significantly impacted?” “What policies need implemented?” Each interview lasted between 45 and 120 minutes, and respondents were guaranteed full anonymity to encourage candor and protect respondents from potential retaliation. Each participant was given a unique respondent number (e.g. Expert Respondent 1 to 23), referred to throughout the rest of the paper.

Given the research questions focused partly on community perceptions and impacts, expert interviews were coupled with community interviews throughout the Copperbelt, where the author met with ASM diggers (*creuseurs* or *kwanda*) and LSM miners as well as artisanal

bosses or chiefs, crushers, carriers, drivers, refiners, safety inspectors, sorters, labor unions and even members of the mining police. In total, 48 of these community interviews were conducted, following the same questions or script as the expert interviews, although usually shorter in duration. The average community interview lasted between 10 and 45 minutes. Each respondent was guaranteed anonymity, and also assigned a unique respondent number shown in Table 1.

Table 1: DRC Community Interview Participants in this Study, 2019

<u>Community Respondent</u>	<u>Title</u>	<u>Institution</u>	<u>Location</u>
1	Safety Coordinator	Gécamines (state-owned mining company)	Lubumbashi, DRC
2	Industrial miner	Gécamines (state-owned mining company)	Kinshasa, DRC
3	Safety inspector	L'entreprise minière Congo Dongfang Mining (CDM)	Lubumbashi, DRC
4	Digger	Artisanal miner, Ruashi	Lubumbashi, DRC
5	Digger	Artisanal miner, Ruashi	Lubumbashi, DRC
6	Digger and sorter	Artisanal miner, Ruashi	Lubumbashi, DRC
7	Driver	Nyati Cross Border Transport (Copper transport and logistics)	Lubumbashi, DRC
8	Owner/manager/boss	Kasulo Artisanal mine	Kolwezi, DRC
9	Digger	Kasulo Artisanal mine	Kolwezi, DRC
10	Digger	Kasulo Artisanal mine	Kolwezi, DRC
11	Digger	Kasulo Artisanal mine	Kolwezi, DRC
12	Digger	Kasulo Artisanal mine	Kolwezi, DRC
13	Digger	Kasulo Artisanal mine	Kolwezi, DRC
14	Digger	Kasulo Artisanal mine	Kolwezi, DRC
15	Sorter and carrier	Depot 169	Kolwezi, DRC
16	Sorter and carrier	Depot 169	Kolwezi, DRC
17	Sorter and carrier	Depot 169	Kolwezi, DRC
18	Carrier	Depot 169	Kolwezi, DRC
19	Refiner/melter	Depot 2	Kolwezi, DRC
20	Refiner/melter	Depot 2	Kolwezi, DRC

21	Refiner/melter	Depot 2	Kolwezi, DRC
22	Carrier	Depot 1000	Kolwezi, DRC
23	Refiner/melter	Depot 1000	Kolwezi, DRC
24	Crusher	Depot Thomas Boss Billy	Kisanfu, DRC
25	Sorter	Depot Thomas Boss Billy	Kisanfu, DRC
26	Sorter and carrier	Depot Thomas Boss Billy	Kisanfu, DRC
27	Industrial miner	Tenke Fungurume Mine	Fungurume, DRC
28	Industrial miner	Ruashi Mining (operating at TFM)	Fungurume, DRC
29	Manager/boss	Solola and Kabica Artisanal Mines	Fungurume, DRC
30	Digger	Solola and Kabica Artisanal Mines	Fungurume, DRC
31	Digger	Solola and Kabica Artisanal Mines	Fungurume, DRC
32	Digger	Solola and Kabica Artisanal Mines	Fungurume, DRC
33	Digger	Solola and Kabica Artisanal Mines	Fungurume, DRC
34	Boss/dealer/trader	Katanga and Fungurume Artisanal Mines	Fungurume, DRC
35	Digger	Katanga and Fungurume Artisanal Mines	Fungurume, DRC
36	Digger	Katanga and Fungurume Artisanal Mines	Fungurume, DRC
37	Digger	Katanga and Fungurume Artisanal Mines	Fungurume, DRC
38	Digger	Katanga and Fungurume Artisanal Mines	Fungurume, DRC
39	Digger	Katanga and Fungurume Artisanal Mines	Fungurume, DRC
40	Captain	Fungurume Mining Police	Fungurume, DRC
41	President	Fungurume Mining Negotiator Association	Fungurume, DRC
42	Officer	Fungurume Mining Police	Fungurume, DRC
43	Chief	Depot 18	Museba, DRC
44	Sorter and crusher	Depot 18	Museba, DRC
45	Sorter and crusher	Depot 18	Museba, DRC
46	Boss/manager	Kawama Artisanal Mine	Lubumbashi, DRC
47	Digger	Kawama Artisanal Mine	Lubumbashi, DRC

48	Digger	Kawama Artisanal Mine	Lubumbashi, DRC
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Source: Author

To complement the interviews, the author also conducted 30 site visits—including 1 archive of mining documents, 11 LSM mines, 2 smelters, 10 ASM mines, 6 artisanal trading depots, and 1 artisanal refinery or processing center. This included mines owned by different entities (Australian, Congolese, Chinese, South African, joint ventures) and locations (Fungurume, Kisanfu, Kolwezi, Likasi, Lubumbashi, Mulunwishi, and Museba) as well as active and inactive mining sites, legal and illegal sites, and sites at exploration phases but also production and decommissioning phases. For readers not familiar with Congolese geography, Figure 2 shows the main mining communities of Fungurume, Kolwezi, Likasi, and Lubumbashi. Each of these naturalistic site visits lasted between 20 and 180 minutes.

Table 2: DRC Site Visits and Naturalistic Observation Conducted in this Study, 2019

<u>Institution</u>	<u>Type</u>	<u>Description</u>	<u>Location</u>
Katanga Artisanal Mine	Artisanal mine	Copper and cobalt mine	Fungurume, DRC
Tenke Fungurume Mine (TFM)	Industrial	Copper and cobalt mine	Fungurume, DRC
Kabica Artisanal Mine	Artisanal mine	Copper and cobalt mine	Fungurume, DRC
Solola Artisanal Mine	Artisanal mine	Copper and cobalt mine	Fungurume, DRC
Tenke Fungurume Mine Concession	Artisanal mine	Copper and cobalt mine	Fungurume, DRC
Depot Laylay	Artisanal trader	Copper and cobalt trader	Kisanfu, DRC
Depot Thomas Boss Billy	Artisanal trader	Copper and cobalt trader	Kisanfu, DRC
Lualaba Copper Smelter	Industrial smelter	Copper smelter	Kolwezi, DRC
Mutanda Mining	Industrial mine	Copper and cobalt mine	Kolwezi, DRC
La Sino-Congolaise des Mines (Sicomines)	Industrial mine	Copper and cobalt mine	Kolwezi, DRC
Kasulo	Artisanal mine	Cobalt mine	Kolwezi, DRC
Djoni	Artisanal mine	Copper and cobalt mine	Kolwezi, DRC
Depot 2	Artisanal trader	Copper and cobalt trader	Kolwezi, DRC
Depot 1000	Artisanal trader	Copper and cobalt trader	Kolwezi, DRC
Depot 169	Artisanal refinery	Copper and cobalt trader and refinery	Kolwezi, DRC
CDM Kasulo	Industrial mine	Copper and cobalt mine	Kolwezi, DRC

Shituru Mining Corporation (SMCO)	Industrial mine	Copper mine	Likasi, DRC
Gécamines Midema Concession	Industrial mine	Copper and cobalt mine	Likasi, DRC
Likasi Artisanal Mine 1	Artisanal mine	Copper and cobalt mine	Likasi, DRC
Likasi Artisanal Mine 2	Artisanal mine	Copper and cobalt mine	Likasi, DRC
Centre de Documentation sur le Katanga et les régions avoisinantes (CEDEKA)	Archive	Repository for mining documents	Lubumbashi, DRC
Gécamines copper smelter	Industrial smelter	Copper smelter and slag storage	Lubumbashi, DRC
L'entreprise minière Congo Dongfang Mining (CDM)	Industrial mine	Copper and cobalt mine	Lubumbashi, DRC
Huachin Mining	Industrial mine	Copper and cobalt mine	Lubumbashi, DRC
Rwashi Mining Commune	Industrial and artisanal mine	Copper and cobalt mine	Lubumbashi, DRC
MMG	Industrial mine	Copper and cobalt mine	Lubumbashi, DRC
Kawama Artisanal Mine	Artisanal mine	Copper and cobalt mine	Lubumbashi, DRC
CHEMAF	Industrial	Cobalt and copper	Lubumbashi, DRC
Depot Samy 888	Artisanal trader	Copper trader	Mulunwis hi, DRC
Depot 18	Artisanal trader	Copper and cobalt trader	Museba, DRC

Source: Author

Figure 2: Central locations for site visits and naturalistic observation

a. Fungurume



b. Kolwezi



c. Likasi



d. Lubumbashi



Source: Author.

Naturalistic observation, or unstructured observation, involves what McLeod (2015: 2) calls “studying the spontaneous behavior of participants in natural surroundings,” with the researcher recording what they see. This helps supplement structured or controlled methods in that it enables examining behavior or events in the real world. Key strengths of the method include greater validity, with highly realistic and authentic accounts being produced that can capture spontaneous events or reactions; little to no interviewer influence or biases of social desirability; and the opportunity to study a situation in its total context and complexity (McLeod 2015). Weaknesses include the lack of a representative sample, the reliance on a small (micro) scale, and inability to replicate findings (McLeod 2015). Hence the utility of mixing naturalistic observation with the other two methods in the study of expert and community interviews.

For all community interviews and site visits, the author travelled with a team of Congolese research assistants who spoke English, French, and local languages. The research team was given exceptional access as our *Ordre de Mission*, our permit to undertake research, was sponsored collectively by the University of Lubumbashi, the Congolese Ministry of Education, both the provincial governors of Haut-Katanga (home to the mines in Likasi and Lubumbashi) and Lualaba (home to the mines in Kolwezi and Fungurume), and the Congolese Secret Service. Our team also included a justice advocate, a Congolese lawyer, to enhance the legitimacy of the visit, but also minimize opportunities for corruption.

To triangulate the data from the interviews and site visits, and also to better position it within the body of growing research, the author lastly conducted an interdisciplinary literature review of studies looking at copper and cobalt mining in the DRC, especially in the former Katanga province, published within the past ten years (i.e., from 2010 to 2019). The Scopus and Science Direct databases were searched for terms such as “copper,” “cobalt,” “mining” and “extractive industries” as well as phrases such as “Congo,” “Lubumbashi,” and “Kolwezi.” Because only a small number of actual peer reviewed studies (about a dozen) were collected, the author repeated the search for non-academic sources including reports, policy briefs, and magazine and newspaper articles. The resulting corpus of approximately fifty studies is cited throughout this study to help situate or confirm its findings within the literature.

3. Contours of the DRC's cobalt mining "boom"

This section discusses the contours of cobalt mining, before describing ASM and LSM activities in the DRC. Cobalt primarily is mined as a byproduct of nickel and copper mining, with only about 2 percent of global cobalt production coming from mines where cobalt is the primary commodity (Al Barazi et al. 2017)—the rest is where cobalt is mined as a secondary metal. In the DRC cobalt is found in five different types of deposits (Tsurukawa et al. 2011). Some cobalt occurs as primary stratiform deposits of sulfides such as Carrollite. Some cobalt is in vein-like deposits along tectonic plates. Some cobalt exists in caps. Some exists in scree deposits or "black earth" concentrated in the bottom of valleys. And some exists in tailings from earlier copper mining. Most cobalt in the DRC is extracted in raw form from one of these five sources, before it is processed into refined cobalt hydroxide or cobalt carbonate.

3.1 A brief history of cobalt mining in the DRC

Cobalt mining in the DRC has a rich history, one that dates to colonial times when the Belgians treated it as a source of cheap food, labor, and land (Honke 2010). Expert Respondent 3 explained the colonial history of the DRC in these terms:

I have always been struck by the fact that the environmental problems in the DRC can be traced to European origins. It made Belgium very rich during colonial times, as it had a monopoly on mining in Katanga. Those mines extracted copper, cobalt, and uranium, the latter even being used in the Manhattan project for the first atomic bombs. The Copperbelt has been called the "geological scandal" because it is so rich in metals, they have almost the entire table of Mendeleev there.

Union Minière du Haut-Katanga (UMHK), a consortium under Belgian control, was nationalized following Congolese independence in 1960 and the Katangan secession in 1963. The parastatal company *Gécamines S.A.* took control over operations in 1967, expanding the mining of copper and cobalt and also further establishing smelters, many of which existed before the 1960s (Prasad 1989). During the 1970s and 1980s, *Gécamines* was the world's largest cobalt and fourth largest copper producer, with a historical peak in production in 1986 (Al Barazi et al. 2017).

However, things started to deteriorate in the 1990s, largely due to alleged corruption and embezzlement within the company (Tsurukawa et al. 2011). In 1992 the provincial governor, seeking to promote entrepreneurship in the trade of metals and metal scraps,

launched “*Opération Mitraille*,” but this turned into a “disaster” for the region as people sold whatever metals they could find (including cables and rail) to Lebanese and Indian traders (Tsurukawa et al. 2011). At the same time, *Gécamines* staff appropriated large amounts of copper and cobalt in the context of unpaid salaries and rivalry between different social groups.

The first Congolese War in 1996 and 1997 only worsened the situation, as the resources were ceded to Laurent Desire Kabila who sought to privatize concessions to gain support with the international community to overthrow the Mobutu regime. This was followed by a second war in which forces in Burundi, Rwanda, and Uganda sought to overthrow Kabila from 1998 to 2003 (Amnesty International 2016a). Amidst all of the chaos, industrial cobalt production deteriorated (reaching all-time lows in the 1990s) and ASM mining accelerated to fill the gap. Kabila further encouraged ASM miners to dig for themselves in *Gécamines* concessions. The World Bank (2007) estimated that during the 1990s, *Gécamines* was so mismanaged and inefficient that its capacity utilization was less than 10%, and that it had accrued external debts of approximately \$2.5 billion.

In 1999, however, Kabila changed tactics and established a government agency to regulate, and tax, this growing mining sector as a vital source of revenue. The *Service d’Assistance et d’Encadrement du Small Scale Mining* (SAESSCAM) was established to oversee artisanal mining, and from then onward mining took off. Expert Respondent 1 explains that:

The 1990s saw ASM expand significantly throughout Katanga. Tens of thousands of miners went into open pits, dug through tailings, sometimes they made their own surface pits. During this first, surface ore, often viewed by miners as the cherry on top of the cake, was almost entirely harvested. You can finance your mining project by selling this ore, as it was often found with 30-40% carbonite, very high. At the beginning, these were exported to Zambia to process plants there, across the border, usually concentrated and exported through to Durban, South Africa. A trade network evolved, with quite a few political leaders involved. This made cobalt and copper a political lifeline. Very quickly, you saw new mining sites emerge in Lubumbashi and Kolwezi, initially supported by local Greek and Indian businesspersons, later by the Chinese.

“*This boom,*” Expert Respondent 1 stated, “*ended in the early 2000s, coinciding with the assassination of Kabila in 2001.*”

After that assassination, his son Joseph Kabila was designated President and began a series of major reforms to open up the Congolese economy to foreign investors, in exchange for new loans. In 2002, the government published a new Mining Code in an attempt to revive the sector and attract foreign investment. The Mining Code established that artisanal mining can only take place within authorized *Zones d’exploitation artisanale* (Artisanal Mining Zones or ZEAs) where industrial or semi-industrial mining is not viable. Artisanal miners were forcefully driven out of many mining sites which were made available to major western and Chinese companies; moreover, very few ZEAs were actually given licenses (Higgs 2017). Expert Respondent 2 believes that the new Mining Code “*stifled almost entirely ASM activities*” and transferred what were “*essentially public resources into the hands of private firms and joint ventures, many linked to the President himself.*”

Then, in 2003, *Gécamines* was restructured so that roughly half the workforce, more than 10,600 employees, immediately lost their jobs—with many of the unemployed joining the already ballooning ASM sector. Expert Respondent 15 reflected on how this was “*devastating*” for the region, given that *Gécamines* was “*a vital part of local economy and it was dismantled and broken apart in a very damaging way to our society and community. All of Lubumbashi was linked to the good working of Gécamines, so the financial catastrophe was felt in every home.*”

After the end of the second Congolese war, and the reunification of the country over 2003 to 2005, and Kabila’s reelection in 2006, further reforms to the mining sector were implemented, transferring more concessions to foreign companies and making many ASM operations illegal. The year 2007 saw 29 joint ventures and privatization contracts issued, and 2008 marked a landmark “Sino-Congolese Cooperation Agreement” under which state-owned Chinese companies invested \$6 billion in infrastructure and \$3.25 billion in *Sicomines*, a joint venture between *Gécamines* and a consortium of Chinese companies with rights to copper and cobalt reserves. Very recently, in 2018, a newer Mining Code came into force, one that attempted to encourage more mandatory corporate social responsibility and redistribution of taxes between national and local governments. Expert Respondent 14 however cautions that “*it is far too early to tell if this reform is being enforced or will have any lasting impact.*”

Despite the major push towards privatization and formalization, the current state of mining in the DRC sees both ASM and LSM operations uncomfortably coexisting.

3.2 Artisanal and small-scale mining (ASM) practices

ASM mining is formally defined by Congolese law as “people carrying out extraction and concentration of mineral substances, using artisanal tools, methods and processes” (Tsurukawa et al. 2011). Other terms used for ASM mining include “semi-industrial” or just “small-scale.” ASM cobalt mining in the DRC generally takes two forms, both of which involve “mining by bare hand” (Amnesty International 2016a). One is where miners, typically adult men, work to dig underground tunnels with shovels, chisels, and mallets as far as 30 meters deep. They mine copper and cobalt beneath the surface. As Expert Respondent 1 explained:

Artisanal miners will usually dig five to fifteen meter deep pits. At the bottom of the shaft they will dig a “living room,” where people sit, then “galleries” going horizontally where they extract the ore in teams of four to five men—more simply cannot fit inside the mine. It takes months of backbreaking work to build the shaft to reach the ore, at least four or eight weeks. Usually the ore is sorted and washed by women and children at the outskirts of the mining site. Then it is sold to traders or directly to buying houses, mainly owned by foreigners. The second type of mining is much less organized. It is where some men, but mostly women and children, collect and dig for cobalt in discarded tailings and slurry close to or even on LSM or industrial sites.

Expert Respondent 3 added that “*the uniqueness of cobalt in Katanga is it is fairly shallow, it is amenable to artisanal mining, people don’t have to dig as deep for other minerals. The extraction technology can be low-level, low-tech, just a shovel, pick axes, and buckets. I have not seen anything that was mechanical, except to sharpen blades.*” A typical ASM worker earns \$1 to \$3 per day and produces 30 to 50 kilograms of raw ore per day. Many times, diggers are pre-financed by a *négociant* (merchant or dealer) who sets terms, including interest and price, before mining commences. Figure 3 shows four of the ASM sites visited by the author, two of the “digging pit” type and two of the “slurry and tailings type.”

Figure 3: Four ASM sites in Katanga, Democratic Republic of the Congo, March 2019

a. Kolwezi, on the backside of the Sicominex concession



b. Kasulo, underneath Kasulo village



c. Kawama, on the backside of a CDM concession



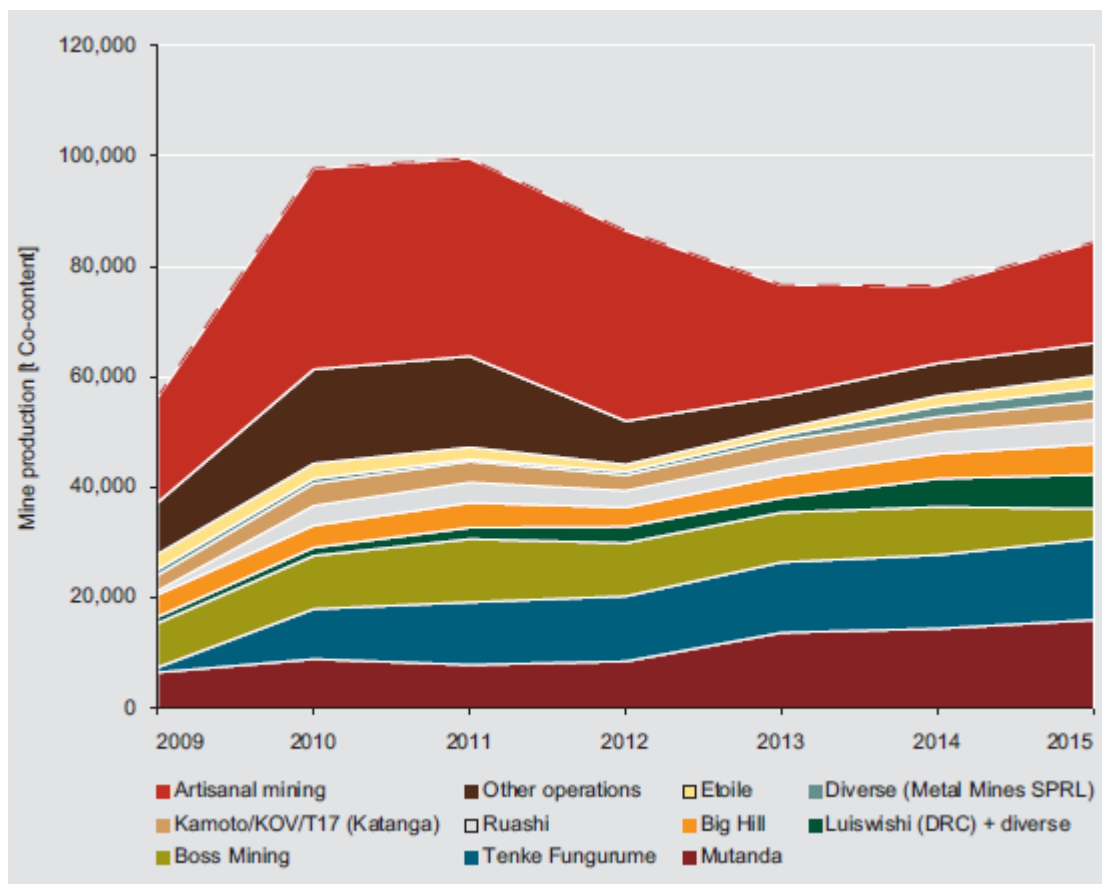
d. Rwashi, on the backside of the CHEMAF concession



Source: Author, with permission granted by each community to be photographed.

Even in 2015, with all of the push for LSM, ASM produced more cobalt than any other single large mine (see Figure 4). Nonetheless, contrary to this sizable level of production, output per individual miner or mine is low, even though collectively ASM accounts for 20% of national supply (Al Barazi et al. 2017), and thus 12.9% of global supply. Lindberg and Andersson (2019) note that many miners are so poor, they cannot even afford a ladder, merely digging extra steps into a pit; they almost never wear a helmet or protective equipment; and in some cases they lack even shovels or hammers and dig by hand.

Figure 4: Cobalt mine production in the DRC by source from 2009 to 2015



Source: Al Barazi et al. (2017)

Given both its questionable legal status and seasonal fluctuations by calendar year and price, a range of estimates exists for the number of people involved in ASM practices. Amnesty International (2016a) estimated that 100,000 regular artisanal miners operated in Katanga, rising to about 150,000 on a seasonal basis. Tsurukawa et al. (2011) also estimated that 67,000 to 79,000 ASM miners were working full time with a seasonal peak of 90,000 to 108,000 miners (see Table 3). They calculated that about three-quarters (74%) of the workforce is diggers with the rest mostly sorters and washers. In terms of market value at this

time, Tsurukawa et al. (2011) estimated that ASM's contribution to the national economy was between \$149 million and \$324 million, or as much as 2.4% of national GDP. The number of ASM miners are comparable in the size of the workforce to those working in the "conflict minerals" sector in the Eastern Congo, notably South Kivu and North Kivu, where they mine gold and 3T (tin, tantalum, and tungsten ores). Across the entire DRC, the World Bank (2008) estimated that the ASM was the "most important" segment of the mining sector because it involved 10 million people or 16% of the DRC's population. Before the second Congolese war, about 90% of all cobalt mining was done using ASM techniques, though now this number has dropped to between 15 to 20%. PACT (2012: 2) similarly suggested that ASM was the "most important segment of the mining sector" and that up to 20% of the population depends on ASM mining in some form. Expert Respondent 5 estimated that *"we have trouble getting the numbers right, but my guess is in Katanga we have between 50,000 and 200,000 people working in the ASM sector, compared to only 3,000 people for LSM cobalt mines."*

Table 3: Estimated number of ASM miners in the Katanga Copperbelt

	Permanent	Peak season
Kolwezi	20,000 ~ 24,000	27,000 ~ 32,000
Tenke-Fungurume	7,000 ~ 8,000	9,000 ~ 11,000
Likasi	13,000 ~ 16,000	18,000 ~ 22,000
Likasi-Lubumbashi	20,000 ~ 24,000	27,000 ~ 32,000
Lubumbashi-Kipushi	7,000 ~ 8,000	9,000 ~ 11,000
Total	67,000 ~ 79,000	90,000 ~ 108,000

Source: Tsurukawa et al. (2011)

3.3 Large scale and industrial mining (LSM) practices

LSM mining contrasts sharply, in scope and scale, to ASM. Industrial techniques utilize much larger machinery and a high degree of mechanization and automation, usually using a mix of surface scrapers, bulldozers, and diggers (Crundwell et al. 2011). Expert Respondent 1 described industrial mining as follows;

Today, at least 13 true industrial scale mining projects are in the phase of production in the Katanga region, many privately listed companies. These new mines are all mechanized and more automated so not as many jobs as predicted, but 1 million tons of copper production exist compared to before the boom (460,000 tons).

Community Respondent 27, an industrial miner, added that:

Much of the Congolese industrial mining is similar to other countries. It has a large number of specialized firms and contractors, with international safety standards. It involves excavators, dump trucks, mechanical equipment, and even some automation. We drill and blast with dynamite. We all have protective equipment such as dust masks or respirators, and the drilling and blasting teams are extremely safe. Perhaps the only unusual thing is the intensity of the shifts—we work 12 hour shifts, and we do 24-7 mining, so it never stops.

Figure 5 shows five industrial mining sites visited by the author, one of them, the TFM mine, so big its concession covers about 1,500 square kilometers, though current mining efforts are concentrated in a few isolated zones. A list of registered domestic and foreign LSM mining companies in the DRC is offered in Appendix I (KPMG 2018).

Figure 5: Five LSM industrial sites in Katanga, March, 2019

a. The CDM mine in Lubumbashi



b. The CHEMAF mine in Lubumbashi



c. The Rwashi mine in Lubumbashi



d. Sicominas in Kolwezi



e. Tenke Fugurume Mine in Fugurume



Source: Author.

4. Highlighting the ostensible benefits of mining in the DRC

Notwithstanding some daunting challenges discussed in the next section, cobalt mining as a whole has brought some discernable benefits to local communities and the state. As Expert Respondent 16 explained, these benefits are diffuse:

The cobalt mining boom has been key in the DRC to jobs and escaping poverty, creating a new middle class. Responsible mining has built schools and hospitals that would not otherwise be there, reaching thousands of people, and it has promoted the much needed image abroad that the DRC is safer for foreign investment.

This section discusses six interrelated and inductively identified benefits to cobalt mining: poverty reduction, community development, regional stability, ancillary markets, state revenue, and a strong social and cultural identity.

4.1 An economic lifeline out of poverty

The first, most direct, and repeatedly mentioned benefit to mining was its ability to offer jobs and alleviate poverty. Expert Respondent 1 commented that “*artisanal mines offer employment to tens of thousands of people, especially during the dry season, mainly young men and a few women and children, and it offers incomes as high as \$30 to \$50 per month, which is high for the region.*” Expert Respondent 12 stated that the mission of the government was to use mining revenues to “*target, guide, and assist in the creation of a new social middle class of miners.*”

Many of the miners themselves the author spoke to talked about the benefits of their work. Community Respondent 30, a digger, noted that “*it’s not easy to find any other job.*” Community Respondent 31, another digger, agreed and noted that “*we have to go into the mines because we need money.*” Community Respondent 34 framed the necessity of mining in terms of learning and investment in skills, commenting that:

We dig everywhere we can, from Lubumbashi to Kolwezi, even into Zambia. By bus. Then we take bicycles and motorcycles to the mine. We need a hovel, a pickaxe, some other basic tools. These are heavy and expensive, it requires a substantial investment to get started, at least 1-2 weeks wages.

Community Respondent 38 added that “*there is no other job for me to have. There are no other good jobs, this is the best one there is. Without it, I would have nothing.*” Expert

Respondent 22 noted that *“Even at the bottom of the ladder, literally and figuratively, ASM miners still have the best paid jobs they can get in their community.”*

This ability for ASM mining to provide a lifeline to those in poverty has been noted in the peer-reviewed literature. Miners in sub-Saharan Africa essentially believe that mining is what Fisher et al. (2009) term the “ladder that sends them to wealth.” Tsurukawa et al. (2011) note that because widespread poverty affects the entire population in the DRC, whole families can become involved in ASM; you will also even see unpaid state agents or university teachers digging for ore alongside migrants or former soldiers. (Two respondents noted their local priest was also a cobalt miner). Faber et al. (2017) found that Congolese households in ASM communities are indeed on average poorer and more vulnerable to income shocks than other groups, with 60% of households in poverty reporting relying on mining for their livelihoods. Mining however enables those households to earn about \$35 per month.¹

4.2 Community development

A second benefit relates to the community development impacts that mining enterprises bring. Expert Respondent 4 noted that, due mostly to mining companies, *“massive investments in infrastructure and economic development have occurred, and they have transformed the region into a modern site of industrial activity.”* Expert Respondent 1 credited LSM with bringing *“roads, shops, malls, and better housing;”* Expert Respondent 5 emphasized the *“jobs, schools, public services, and health stations”* mining operations bring; Expert Respondent 14 that mining companies offer *“drilling wells for water supply, playgrounds, and even libraries.”* Other respondents mentioned how ASM operations generated income for paying school fees, or improving community food security.

Granted, these benefits are highly dependent on the type of mining firm and the extent to which it promotes good governance and community empowerment. One respondent noted that such foreign firms can adhere to stronger standards concerning human rights or labor. As Expert Respondent 22 stated, *“multinationals are vigilant and take a no tolerance policy towards child labor.”* Honke (2010) describes this process of LSM creating “bubbles of company governance” where mining companies provide everything themselves, including security, transport, living quarters, even water, food, health care and education. Indeed,

¹ Note, however, that section 5 does contest some of these economic dimensions, or at least places them in perspective. Section 5 also notes the issue of food insecurity that possibly results from the diversion of workers from agriculture to mining.

Figure 6 shows multiple community assets built exclusively by the TFM mine in Fungurume, including two schools, two water pumps, and a club for youth.

Figure 6: Community infrastructure developed by the TFM mining company in Fungurume, March 2019

a. A primary school



b. A drinking water station



c. An elementary school



d. A water well



e. A social club for youth



Source: Author

4.3 Opportunity for migrants and refugees and regional stability

A third important benefit relates to regional stability, and especially the safety and protection of migrants and refugees. Expert Respondent 6 added that “*artisanal mining provides livelihoods and revenue to some of the poorest families in the Congo, which is one of the poorest countries in the world, who have lived through war, strife, and continual conflict. Refugees and migrants are unskilled, so what else can they do?*” Expert Respondent 14 emphasized how ASM mining provided a “*lifeline*” for some of the most vulnerable in the DRC, especially “*refugees feeling conflict as well as orphans.*” The World Bank (2007) confirmed this was the case in their research, noting that mining provided a safe haven for millions of internally displaced persons fleeing two wars, foreign army invasions and occupations, militia activity, and ethnic conflict.

Correlated with creating a safe space and the creation of a middle class is a political benefit of being one of the best governed provinces in the country. Expert Respondent 14 praised mining for bringing “*political stabilization.*” As they continued:

Because of its mineral wealth, this province Katanga (now four provinces of Haut-Katanga, Lualaba, Haut-Lomami, and Tanganyika) is the best governed in the entire country. It is the safest, richest, and most stable.

Expert Respondent 7 said that they thought that the Katanga region was “*the best governed in the country, the best run and the place with the most opportunity.*” Expert Respondent 22 remarked that “*mining has made Katanga the most prosperous and stable part of the entire country.*”

4.4 Ancillary benefits, markets and services

A fourth benefit referred to the rich secondary markets and ancillary services that mining opens up. Expert Respondent 11 commented that “*mining creates secondary spillovers, everything from trading depots and refineries, to shops selling food and water to miners.*” Figure 7 for instance shows such shops around Fungurume. Expert Respondent 13 noted how in Kolwezi, LSM mining has generated large amounts of rock and sand that are used by the community as a byproduct to make cement. As they noted, “*mining is a magnet for other economic activity.*” Expert Respondent 9 estimated that trade in Katanga for shovels and sacks alone was a \$1 million annual enterprise.

**Figure 7: Secondary markets and ancillary services for mining in Katanga, DRC,
March 2019**

a. Sand mining on the Sicominex concession



b. Utilization of Sicominex sand to make cement



c. Trading depots near Fungurume



d. Shovels and mining tools for sale



e. *Food markets around the TFM mine in Fungurume*



Source: Author, with permission granted by each community to be photographed.

4.5 State revenue and economic growth

In tandem with these benefits, mining has provided strong regional growth and significant state revenue.² Expert Respondent 6 remarked that “*cobalt mining in the Congo results in positives at the macro level such as foreign exchange, high royalties, and fiscal revenue.*” Expert Respondent 8 emphasized that a benefit to mining was “*technology transfer development as well as a form of linking to international trade and markets.*” Expert Respondent 11 suggested that “*the future of the DRC state rests on mining.*”

The World Bank (2008) affirmed many of these statements, calling mining the “engine of the Congo economy” and projecting under a base case scenario that the mining sector generates \$186 million to \$388 million in gross production value every year. This means mining as a whole contributes 97.5% to national exports, 20% to national GDP, 24.7% to government revenue, and 23.9 % to formal employment (EITI 2019). Reuters (2019) also reported that the mining sector as a whole paid \$1.57 billion in revenues to the government in

² Although aspects of this are problematized in Section 5 below, especially concerning corruption.

2018, and that this amount almost doubled (up 91%) from the previous year. This amount may only scratch the surface, with Higgs (2017) speculating that the DRC could have \$214 *trillion* in untapped mineral resources.

4.6 Social and cultural identity

A final, more prosaic but nonetheless salient benefit to mining is its contribution to creating a strong sense of social and cultural identity. Expert Respondent 2 explained that *“many Congolese are proud to be miners, or proud that the country leads the world in something.”* Tsurukawa et al. (2011) found this to be true in their own research, noting that many ASM and LSM miners find their job highly satisfying, and that the government and private sector alike envision mining as contributing critically to sustainable development. Cuvelier’s (2014, 2017) ethnographic work with mining communities in Katanga also confirms how mining becomes a part of household and personal identity.

5. Revealing the mounting risks of mining in the DRC

The benefits of mining, while real, sit starkly in contrast to six mounting risks: accidents and occupational hazards, environmental pollution and degraded community health, exploitation of miners and unfair market practices, the erosion of democracy via corruption and malfeasance, displacement of indigenous peoples, and in the extreme violent conflict.

5.1 Accidents and occupational hazards

The first potent risk refers to fatal accidents and landslides inside mines, especially ASM shafts, as well as occupational exposure to dust and other medical ailments from ASM and LSM operations. Expert Respondent 21 explained that:

ASM mining for cobalt and copper is some of the most dangerous in the world. It’s not like gems, which are embedded in rock and can be extracted fairly easily without risking mine collapse. It’s not like gold, which is mined in seams no more than a meter or so in depth, meaning you mine around the seam. No, copper and cobalt mining is like removing entire blocks at a time, excavating an entire shaft of a mine so that’s as big as a bus or small assembly hall. Then it falls in on you.

Expert Respondent 7 underscored the occupational vulnerability of miners as follows:

Artisanal miners work in terrible conditions. They are at the bottom end of the mining industry, in every imaginable way. There are no trade unions to defend their rights, no specific cooperatives that try to improve conditions. Too many important

political individuals profit from the mining industry being as it is, to make it safer.

The labor conditions within ASM are poor, dangerous, hazardous, and horrific.

Expert Respondent 14 added that “*most ASM operations are poorly managed societies, enterprises with just one boss and a few workers. The boss is the biggest beneficiary, and he treats his workers or cooperatives members quite badly. There is nonexistent health and safety training, and an absolute lack of willingness and knowledge to make things better.*”

Interviews with the miners themselves brought these concerns to the forefront.

Community Respondent 9 stated that “*The danger is always the wall. You never know when rocks will fall or the mine will collapse. So far my team has been lucky, but I don’t know how long that luck will last. I have nightmares when I sleep about that wall trapping me, crushing me.*” Community Respondent 29 noted that he always “*felt sick and scared of accidents. One of my diggers was in a hole, and a stone fell and crushed him. He lost both his legs.*”

Community Respondent 36 talked about how “*I know of many friends involved in accidents. We have avoided them on our team but not because we are better or worse, we are more or less careful, have better or worse equipment. We have just been lucky, that is all, and some day our luck may change.*” Community Respondent 37 mentioned that they “*breathe dust all the time, and have a cough that won’t go away.*” Indeed, Figure 8 shows portraits of four ASM miners the author interviewed, all with coughs, possible signs of silicosis, and all with red eyes from dust.

Figure 8: Four ASM miners in the Fungurume and Kolwezi region of Katanga, March, 2019





Source: Author, with permission granted by each miner to be photographed.

It is not just miners, either, who face occupational hazards. Community Respondent 46, who worked at a cobalt depot, talked about the hazardous nature of transport. They said *“To get here to the depot, if I put a sack of cobalt on my bicycle, it is too heavy to pedal. It*

must be pushed like a wheelbarrow. When that happens, it can take 8 to 12 hours just to reach the destination, even traveling at night, and you have to dodge the trucks, buses, and traffic.” The author would note that when they picked up a single sack of cobalt, half full, they could barely lift it. (Such sacks are often as heavy as 70 kilograms). Community Respondent 47 also spoke of transport safety commenting that “*many children or young adults do get run over by fast moving buses or trucks on the highway. Others are robbed, or disappear.”*

Still others discussed the hazards of sorting, processing, and crushing cobalt ore. Community Respondent 43 mentioned that:

After ASM miners deliver sacks of cobalt via motorcycle, car, bicycle, and sometimes on foot, we take their name, and ensure they are registered. Second, we check their product, and separate the rocks inside. Green blue is copper, cobalt is dark brown and grey. Third, we treat the product chemically before we pass it to our Chinese boss, who ensures it is taken to Lubumbashi. But this is backbreaking work, and after we are done each day our bodies are tired and hurt everywhere.

In this way, other parts of the cobalt supply chain can pose occupational dangers.

Some respondents discussed how mining places *entire communities* at risk. Expert Respondent 4 explained that:

Proximity is the problem. People migrate and settle literally on top of the mine. When landslides happen, homes and walls crack and fall apart, people are injured by projectiles.

During our visit to Kasulo, multiple respondents discussed how after the community discovered cobalt below homes, they tore them up to get at it, even causing a major landslide that killed dozens. They dug in gardens, inside homes, inside streets, inside backyards. Figure 9 for example shows a collapsed road from that landslide. Lindberg and Andersson (2019) write about how when they visited Kasulo, they were told the local pastor broke up a large hole in the church floor to mine for cobalt, thinking he would strike it rich.

Figure 9: Landslides and collapsed roads caused by ASM in Kasulo, March, 2019



Source: Author

Many of these health and occupational hazards are confirmed in the literature. Amnesty International (2016a) does note that ASM accidents are “common” and that unsupported tunnels collapse “frequently.” Further complicating matters, many accidents go unreported and bodies, and in some cases entire mining teams, are merely buried underground. At least 80 miners died in accidents between September 2014 and December 2015, with many being buried alive after heavy rains (Amnesty International 2016b). Tsurukawa et al. (2011) calculated that annual death rates for the ASM sector range to between 0.4 to 0.5% of the workforce—or if one goes with the number of 100,000 miners, 400 to 500 deaths per year. They added that the danger of landslides is permanent; that the risk of accidents increases during the rainy season; and that other than being buried alive, many accidents also lead to suffocation or drowning. Hinton et al. (2013) note that other constant dangers to ASM mining include chemical poisoning from mercury and cyanide (especially for gold mining), methane and coal dust explosions, electrocution and death through the inappropriate use of underground explosives and resulting fires and explosions. Hinton et al. (2013) add that even though ASM accidents are systematically underreported,

the data that does exist suggests that ASM mining is still six to seven *times* more likely to have accidents than LSM operations. Elenge et al. (2013) report that in one particular part of Katanga, Lupoto, 392 accidents at ASM occurred in one year, affecting 72.2% of miners. Elenge et al. (2011) described how diggers face the ever-present risk of mine collapse, suffocation, dehydration, and polluted air; crushers face the chronic risks of ocular traumatism (vision loss and eye damage); loaders face exposure to handling heavy loads. The World Bank (2007) writes that “the welfare and labor conditions of virtually all ASM mines is appalling and miners are generally completely ignorant about basic occupational health and safety, with many injuries and fatal accidents ... Most incidents are caused by; widespread appalling and unsafe working conditions, and exposure to mercury (*orpaillage* activity), dust, fumes, rock falls, landslides, underground stope collapses and ground failure. There are also the effects of poor ventilation and lighting, over exertion and inadequate work space.”

5.2 Environmental pollution and degraded health

A second immediate and localized impact to both types mining are its negative impact on the natural environment, with deleterious consequences on public health. This came up repeatedly in our interviews as well as the peer reviewed literature.

For example, Expert Respondent 1 noted that:

Cobalt mining brings severe environmental impacts, pollution of the rivers and the soil and even of the people. You have multiple pollution streams: pollution of the vegetables and farms. Pollution through dust. Pollution through the air. High levels of cobalt are in the urine and blood of mining workers and in entire mining communities. This is alarming for the children, women, and young men. Pollution is quite obvious when you arrive in Lubumbashi, you can taste it in your mouth. Hundreds of trucks drive around or through the city center arrive every day, adding to the dust. Another big unknown is the impact of uranium, which spreads radioactive tailings across multiple sites ... Looking at the mining environment feels like being on the moon. Tailings are everywhere, rocky barren landscapes dominate the view, devoid of life.

Expert Respondent 6 called mining activities “*quite devastating to local ecology.*”

Community Respondent 28, an industrial miner, framed it by commenting that:

The industrial mining process for copper and cobalt here essentially ravages the environment. It is almost identical to the mountain top removal processes for coal in the United States, except without the environmental standards and we use more acid. We blast apart whole mountains and forests, and generate massive amounts of waste, tailings, and slurry that gets dumped into the wilderness, or as is often the case, next to communities and the miners themselves.

Indeed, Figure 10 shows the presence of acid, dust, and tailings witnessed during the field research. Some, like the Kasulo ASM, are literally in the backyards of homes, next to drying laundry or food storage.

Figure 10: Environmental calamities with cobalt mining in the DRC, March 2019

a. Shipments of acid near Fungurume for the TFM mine



b. Mine dust near the CDM mine in Lubumbashi



c. Tailings from the Kawama ASM



d. Tailings from the Kasulo ASM



Source: Author

Numerous articles have confirmed the depth and extent of environmental pollution with cobalt mining. Banza Lubaba Nkulu et al. (2018) write that mining dust containing cobalt and other metals, including uranium, can be inhaled into the lungs and ingested through contamination of food and other items, especially by children. Lindberg and Andersson (2019) collected measurements of cobalt and metals in soil, and found it exceeded the Swedish safety limit by more than 100 times. Tsurukawa et al. (2011) add that mining also affects water quality and availability, with many minerals washed in local rivers that are also routinely used for cooking, bathing, and drinking. They also noted that radiation dose rates near piles of ore, even at depots, often exceed international standards for radiation workers. The World Bank (2008) called the environmental impacts of mining in the DRC

“deplorable.” In a special report on ASM, the World Bank (2007: 10) suggested that the environmental impacts from ASM mining cut across:

- Biodiversity loss and the destruction of natural habitats through mines and disposal sites;
- Air pollution through emissions and discharges;
- Siltation of wetlands and riparian areas from processing slimes;
- Changes in river ecology due to pollution, sedimentation, and flow modification;
- Deforestation;
- Soil erosion;
- Land instability and ground subsidence.

Thus, the World Bank (2007: 10) concluded that ASM as a whole was “virtually always environmentally destructive as the sector operates in a clandestine manner with little regard or respect for the local environment or ecosystems; resulting in the direct dumping of waste, tailings, effluents, river damage in alluvial areas, mercury pollution, land degradation and soil erosion, deforestation, and the loss of biodiversity.”

These activities not only damage the environment, they threaten public health. Sadly, the impacts are not limited to miners or even mining sites. Banza Lubaba Nkulu et al. (2018) collected blood and urine samples from 72 residents of the Kasulo ASM, including 32 children, and noted that “children living in the mining district had ten times as much cobalt in their urine as children living elsewhere.” They found more DNA damage in children in the mining area than in a control group. Kayembe-Kitenge et al. (2017) report a higher risk of congenital birth defects. Amnesty International (2016a) warned how chronic exposure to cobalt dust leads to a potentially fatal lung disease, called “hard metal lung disease.” Inhalation of cobalt particles can also cause “respiratory sensitization, asthma, shortness of breath, and decreased pulmonary function”, and sustained skin contact with cobalt can lead to dermatitis. One woman who said she carried 50 kg sacks of cobalt ore told Amnesty International (2016a) that “We all have problems with our lungs, and pain all over our bodies.” Banza Lubaba Nkulu et al. (2009) used biomonitoring to document that those merely living close to mines in the DRC had elevated levels of copper and uranium in urine as well as “significantly higher” concentrations of cadmium, copper, cobalt, and uranium in the blood. As the study concluded, “The extremely high levels for cobalt and the high levels of other toxic metals in the urine of these subjects from the general population of Katanga

confirm that they are significantly exposed to these metals through their environment.” Nemery et al. (2018) also confirmed the presence of other trace metals such as uranium, manganese, lead or mercury in urine or blood, depending on the type of jobs. Squadrone et al. (2016) documented that the severe contamination of lakes and rivers where cobalt is washed, and where slurry and runoff flows, such as Lake Tshangalele, enters community food supplies and staples as people rely on fish to eat, or those water sources for drinking water.

A final link to health concerns not environmental degradation, but the spread of disease in mining camps. Tsurukawa et al. (2011) write that mining camps—for both ASM and LSM—often lack sanitation and hygiene, and they feature frequent prostitution or promiscuity that further spread sexual infections or HIV/AIDS. The World Bank (2007) confirmed “deteriorating health conditions” in mining camps and noted that they both lack public health facilities and are ideal sites for where malaria and other parasitic and communicable diseases related to poor sanitation, such as cholera, dysentery, diarrhea, and tuberculosis, are spread.

5.3 Exploitation and unfair market practices

Miners face not only the risk of accidents or contributing to environmental pollution that poison them. They are also exploited by their bosses, by trading companies, and by other actors involved in the political economy of cobalt. These features are only exacerbated by an extremely volatile price for cobalt, which was trading at \$30,000 per ton in early 2019 but had reached an all-time high of \$95,250 per ton in March of 2018 and a low of \$21,750 in February 2016, as Figure 10 indicates.

Figure 10: Global prices for cobalt (US\$ per ton), 2014-2018



Source: Trading Economics (2019).

Multiple miners discussed being taken advantage of by either the bosses they worked for, the companies they sold cobalt to, or LSM operations that artificially depressed the price of cobalt. Community Respondent 8 said:

I am very angry about CDM and other concessions. Since they have come, my livelihood and my family suffer. The price for cobalt is too low, and CDM pays less than market prices, which hurts us even more because we cannot compete with them on an open market. We are displaced and undercut with prices at the same time.

Community Respondent 29 confirmed this and noted:

When we go and sell cobalt, we run into problems. We do not get a fair or normal market price, always we are undercut by the industrial firms, and the prices are always low below the proper price. We are all parents, we have to support our children, but it is becoming increasingly difficult to do so.

Community Respondent 39 talked about “double taxation” and added that “we can never get enough money, the mining police always taking a share of my cut, then hen we have to sell below market prices anyways.” Community Respondent 46 spoke again of prices being too low, so low that the traders now exploit the diggers and pay only for the copper, demanding the cobalt is “free” as a tax. Community Respondent 44 explained that currently (as of March

2019), the depots say they “*don’t want cobalt, copper is more profitable, I give them cobalt for free.*”

Indeed, the author saw more than 200 depots during the field research, from literally “Depot AAA” to “Depot Z” as well as many ones in between. Some had the names of bosses, “Depot Jeef” and “Depot Kenedy,” some were intended to be lucky e.g. “Depot 888” and “Depot Number One”, others were just odd, such as “Depot Vice Versa” and our favorite “Depot Boss Billy.” All of these, however, existed to try and collect ASM cobalt and at times take advantage of miners. Banza Lubaba Nkulu et al. (2018) reported that ASM miners sell their raw metals to Chinese, Indian or Lebanese companies for further export to cobalt-refining countries (China, Belgium, Finland and Canada). Our research confirms this point, but also finds that those companies always try to put pressure on the miners for the lowest possible prices.

Although not directly identified in the existing literature, studies do discuss how the DRC faces exploitation from foreign firms to attract industry and keep prices low. For example, Marysse and Geenen (2009) reported that between the 1990s and 2000s, the Chinese share in African trade jumped from 0.8% to 9%, more than a tenfold increase. In real terms, this increase was even larger, rising from \$1.5 million in 1995 to \$368 million in 2005. Copper, cobalt, and gold joint ventures with China are the largest trade investments China signed in all of Africa for that decade. But these agreements were criticized for unequal exchange, with China taking two-thirds of the profits. These agreements also enabled the Chinese to buy at prices below world market levels. They lastly stipulated requirements that the DRC would reimburse firms if they failed to meet expected production levels or profit margins. Mohan and Power (2008) thus caution that mining will not challenge fundamentally Africa’s extroverted relationship with the world economy, which keep it at a perpetual disadvantage and locked into supplying raw materials to global markets, rather than adding value to the local economy.

5.4 Political corruption and corporate malfeasance

A fourth concern is more political, and it relates to the impact of mining on the erosion of national democracy as well as corruption within the state, as well as malfeasance among mining companies. Indeed, the author witnessed much of this general corruption firsthand, from the airport customs and immigration authorities (who asked for money) to

cashiers at grocery stores (asking for money or not giving change) to the national police, local police, and military (all asking for money).

Expert Respondent 1 noted for example that “*mining contracts and the mining code by and large have been merely instrumentalized to build wealth for powerful political figures, especially the President.*” Community Respondent 1 stated that “*mining in the DRC does not benefit local communities, it is only corrupt politicians who are getting rich.*” Community Respondent 2 framed this actively in terms of democracy, saying that:

The biggest threat to democracy as a whole in the DRC is not war, or poverty, but mining. Mining prevents the capability of the Congolese people to be governed by those they like. The mining sector and the state capture of resources undermines development for the whole country. It allows them to run the show and buy off whatever they need to prevent real democracy, freedom of speech, and free and fair elections. Mining has undermined the whole nation.

Expert Respondent 6 elaborated that:

The political costs of cobalt mining are grave. Mining royalties create a very narrow political elite, particularly in Kinshasa, which results in counterproductive governance dynamics, where the elite are accountable to mining companies but not to the people. A toxic governance structure has arisen enclaved around mining benefits, and a small clique around the presidency. Cobalt mining has had very high growth rates the past decade, but most people have not shared or benefitted from that, instead, their situation has stagnated, or even gotten worse.

Expert Respondent 3 added that even though there were many “*honest, bright, non-corrupt people,*” still “*many mining inspectors are bought off*” and “*corruption is pervasive and usually backed with money and weapons.*” Expert Respondent 8 agreed that “*corruption is rife in the DRC, the government shows little interest in anything other than mining, not health care, education, or public investments.*”

Some of the literature has confirmed aspects of this corruption. Amnesty International (2016a) documented that “state officials [are] aware of the mining activities taking place in unauthorized locations, but they also financially benefit from them. Officials from a range of different government and security agencies control access to unauthorized mining sites and demand illegal payments from artisanal miners.” Kara (2018) also documented that

numerous diggers, especially children, reported that they pay bribes to local government authorities to ensure they could skirt around child labor laws and human rights protections. Zeuner (2018) argues that widespread corruption completely prevents the correct or equitable distribution of state revenue from mining. Titeca and Edmond (2019: 542) identified parallel issues in another extractive industry, oil, and noted that “the main function of the oil sector is patronage and regime security” and that perhaps perversely, corruption was “too visible” to be punished.

Calls for political reform seem stymied in the face of this corruption. The ASM community, for instance, lacks an effective and nationally representative union, and organized social movements in the DRC for mining rights are scarce. Community Respondent 2 noted that the system itself was insulated from reform, with:

A lack of cohesion to mobilizing against corruption ... I have rarely seen communities push back against mining, even big industrial projects, there is no real opposition. The only opposition you see is those in dire straits, directly displaced or affected, mainly the artisanal miners. But this is ad hoc, and site by site, not necessarily organized or lasting.”

Expert Respondent 2 affirmed this and noted that:

Protests are always very local and they are quickly shut down. They never spread. They involve rocks and the burning of the occasional truck, but they never result in any true diplomatic impact or pressure, no unionizing of cooperatives, no organization and more effective forms of protest. Whomever would defend these communities is usually bought off by the state or the companies.

This inability for labor groups to protect workers has linkages to many of the other dimensions discussed in this section, including occupational accidents and patterns of exploitation.

The World Bank (2007) confirmed this point when noting that “no democratic organization into associations or co-operatives is followed to provide a single ‘voice’ that could help the ASM in conducting pricing or workplace negotiations, mobilizing assistance programs, conducting awareness campaigns amongst its members and organizing security and other mine site related activities.” De Haan and Geenen (2016) even found that mining

cooperatives in another region of the DRC, South Kivu, further entrenched the exploitation of local miners after they were coopted by elite interests.

Even then, when local political actors may try to promote mining rights, or make public investments, they lack the fiscal skills or knowledge to make sound choices. Expert Respondent 14 commented that:

Even when revenues end up in non-corrupt political institutions, they don't know what to do. Local authorities are provincial and shortsighted. When awarded mining royalties, they never had so much money before, they don't know how to spend or manage it well. Mining companies can pay the taxes, but then the local authorities spend it on something ridiculous like 20 football fields. They are not trained in responsible fiscal management, or in designing community development funds.

Expert Respondent 7 remarked that “sometimes you may have the best of intentions with a new political figure, but without a regime change and total political shift, even they can do little to improve the system.” The implication is the improper training would still result in mismanagement even if officials didn't have vested interests and/or a desire to be corrupt.

A final political risk from mining is corporate malfeasance alongside state corruption. Community Respondent 1 made a distinction between types of mining conglomerates, stating:

Generally, European and American mining companies are respectful of the environment and communities. However, generally Asian companies (Chinese, Indian, etc.) or Australian companies are not respectful of the environment and communities. They actively corrupt the agents of the state who have to audit.

Community Respondent 2 however challenged this point, noting “they are all bad” and that “Glencore and ERC are some of the least ethical players of all.” Expert Respondent 18 remarked that “Companies like Glencore don't care about the Congo at all. They only care about their own financial power, and their shareholders.” Expert Respondent 20 agreed and stated that “industrial mining companies are benefitting from the weakness of the state, taking control in a vacuum and operating with accountability to nobody.” There is some evidence to back up these claims, with Katz-Lavigne (2019a) reporting that Glencore was sanctioned and fined (including the banning of executives) by the Ontario Securities Commission in Canada for misreporting the amounts of copper and cobalt extracted; the U.S. Department of Justice

was also investigating Glencore for bribery; and Glencore, ERC and Chemaif have been linked to violations of environmental standards and/or other bribing scandals.

5.5 Displacement of indigenous communities

Although less frequently mentioned, a fifth potent impact was the displacement of indigenous people as well as negative effects on community stability, including food security.

Expert Respondent 4 commented that:

Mining activities do displace communities, you have the forcible moving of villages away from concessions, or changes in where the road goes, or the closing off of hunting grounds or agricultural areas. This is especially the case for some indigenous groups or ethnic groups, who see their sacred sites disappearing or cannot get to fields or areas of cultural significance.”

Community Respondent 1 framed it at the nexus of indigenous peoples, land rights and food security:

As a mitigation measure, mining companies decide to move the communities (resettlement) by building new homes better than the first ones, which are destroyed. But really, you have degradation and acquisition of the land, and also pollution of other sources of livelihood from the collection of wood, mushrooms, or charcoal, as well as the loss of some medicinal plants. The acquisition of their land for the construction of the mine's infrastructure, a factory, offices, mining traffic routes, etc., has harmful consequences that can lead to food insecurity and severe disruption to communities. In my view, indigenous communities are hit hard by these practices.

Expert Respondent 5 mentioned indirect impacts such as how “*an influx of miners, industrial or artisanal, can be a challenge for local communities, especially as they are their families take jobs and economic opportunities locals cannot compete with. Mining has a corrosive effect on indigenous groups and their identity, with communities usually suffering from lack of cohesion and tension.*”

Such sentiments, although less frequently mentioned, have been affirmed by some previous research. Tsurukawa et al. (2011) noted that because miners tend to have higher incomes than the rest of the population, their presence in a community results in local inflation and access to essential goods can become difficult for indigenous groups. Over the longer term, interactions with mining communities can lead to other negative social impacts

within indigenous communities, including prostitution, polygamy, drug abuse, and alcoholism. Tsurukawa et al. (2011) also reported “claims of severe human rights violations towards Pygmy communities in the mining sector of Katanga.” The World Bank (2007) cautioned that ASM activities can be corrosive on indigenous communities as well, with pupils leaving school to work on nearby ASM sites, and with many indigenous peoples deciding to abandon traditional livelihoods in favor of the “get-rich-quick” mentality of mining. The World Bank (2007) also confirmed the effect of mining on local inflation, and linkages to the abandonment of farming and other traditional practices.

New resource discoveries, when they occur, can contribute to community tension and conflict. The World Bank (2007) reported that whenever a new resource site is discovered, massive numbers of Congolese migrants “rush” into the area to try and extract the minerals, usually conflicting with local communities. Then, once a new mining site is established, the World Bank (2007) noted a “boomerang effect” where the localized inflation brought about by mining then makes it harder for local communities to meet basic needs. This has led in some communities to higher costs for basic commodities and food, increasing rates of malnutrition, and “new social problems resulting in xenophobia, community tension and antagonism.”

5.6 Violence, riots and murder

A final serious risk is violent conflict and death. Expert Respondent 1 described:

A constant state of conflict between ASM and LSM interests, with LSM companies forcibly evicting ASM miners from sites which can lead to protest and violent reaction against the mining companies, and against the state over processes of eviction. The mining security forces escalate the conflict by arresting or beating protesters; the protestors respond by burning company trucks, throwing rocks, even burning or looting community development centers.

Expert Respondent 2 noted that “many ASM workers are shot and killed.” Expert Respondent 6 agreed and commented that:

Cobalt mining perpetuates cycles of conflict and violence and political patronage to the very system that is leading to protesting, rebellion, and unrest. There are even dozens of killings created by the military and police, who do repel armed attacks on mines. There is no such thing as clean or conflict free minerals when it comes to the DRC.

Expert Respondent 15 linked it back to the point above about corruption and violence going hand in hand,³ noting that “*corruption has built an economic empire in the DRC, and like all empires, it has military strength and the ability to entrench and expand itself.*”

The miners the author spoke to, themselves, validated these issues, with Community Respondent 6, Community Respondent 14, Community Respondent 15, and Community Respondent 44 all mentioning being beaten, robbed, or detained by security forces or police. Community Respondent 45 framed it more as tensions and conflict between mining teams, the police, and industrial mining operations, saying “*it’s almost like a third Congolese war sometimes.*” Community Respondent 1 discussed how clashes a few years ago in Kolwezi between ASM activists and a Chinese mining company left “*several people dead, including expatriates.*”

It was not only experts and diggers from mining teams that discussed such violence. Members of the police, unions, and bosses also confirmed these trends. Community Respondent 42, a member of the police, admitted that:

The conflict between industrial and artisanal miners is very real. Because the main mining sites are now so secure, artisanal miners have been pushed to the periphery. I see them picking through the waste dumps and tailings, and they also are known to steal the batteries and fuel from our machines. When we catch them doing that, of course we beat them before we call in the police.

Community Respondent 29, chief of an ASM team working in the Fungurume concession illegally, remarked that:

We work on the illegal concession on the TFM plot, and we are always worried the police will come. We deal with harassment all the time, the police coming not in their uniforms, trying to catch us. Dogs barking. Gunshots being fired. I have been arrested many times. If you are a digger or a trader or a dealer, it is always difficult. We are always running, always scared, always hunting, and always stressed. The police take all of our money if caught. If we do not have enough money, they take the product; if not the product, they take our tools and materials. If we have none of those, we are beaten. This now occurs not only at mines, but also at the trading depots, where the police try to steal from us too.

³ See section 5.4 on “political corruption and corporate malfeasance.”

Community Respondent 40, a captain of the mining police, also said “*my job is simple, to keep the concession clear of diggers, in every way possible. Illegal miners are parasites.*”

Callaway (2018) adds that due to the lack of regional stability, many mining sites are becoming increasingly militarized. They report that 18% of mines in Katanga are secured by the secret service and 13% by the Republican Guard, an elite security force controlled by the President of the DRC. The research team witnessed this militarization firsthand as well, with weapons, soldiers, and police everywhere in Katanga, and the author threatened more than once at gunpoint.

Such stark tensions have been repeatedly confirmed in the literature. Katz-Lavigne (2019a) reports that after ASM workers are pushed off a concession for industrial foreign firms, the result is often a series of conflicts, injuries and deaths as miners battle with security forces. Katz-Lavigne (2019b) notes how in Katanga, “LSM-ASM conflict manifests in multiple ways along a continuum, including no conflict; tense interactions and implicit threat of violence; the explicit threat of violence; the use of force to injure or sabotage; and the use of force to (attempt to) kill.” She notes that many ASM miners are arrested; that while most security guards do not carry weapons, they still physically beat miners, sometimes repeatedly; and that it is not security forces that are always to blame, sometimes the miners themselves will attack security guards by throwing stones at them at train stations. Indeed, Katz-Lavigne (2019b) reported how at one mining company, 64 injuries of security guards were reported in 2017. Radio Okapi (2018) reported that clashes between the mining police and ASM miners within the concession of TFM resulted in two diggers being killed by bullets. Tsurukawa et al. (2011) also confirmed that ASM miners who sneak illegally into concessions by night are often shot at, beaten, or drowned in waterlogged pits in the dark.

6. Policy recommendations for improved mining governance

This part of the analysis relates not to benefits and risks, but policies for better governing cobalt mining in the DRC. Given the dynamic and multi-scalar nature of the political economy of cobalt, this section has organized its suggestions across four different stakeholder groups: local and national government; industrial (and often foreign) mining companies; ASM miners and their communities; and the manufacturers of electronic products using cobalt. Table 7 previews and summarizes the policy suggestions for these stakeholders.

Table 7: Seven policy suggestions for better governing cobalt mining in the DRC

Scale/Actor	Policy suggestion(s)
National and local government	<ol style="list-style-type: none"> 1. Enforce better occupational standards for ASM operations 2. Form joint ventures with ASM and LSM interests 3. Implement better dust and tailings management at LSM mines
Industrial mining companies	<ol style="list-style-type: none"> 4. Pursue broader and more robust community benefit sharing agreements
ASM communities	<ol style="list-style-type: none"> 5. Support training for alternative livelihoods
Electronics manufacturers and suppliers	<ol style="list-style-type: none"> 6. Recognize the limitations of traceability schemes and formalization 7. Do not ban ASM cobalt

Source: Author. Note: ASM=Artisanal and small scale mining. LSM=large-scale and industrial mining.

6.1 National and local government

For national and local government policymakers and planners, the data suggests three mechanisms: (1) enforce better safety and occupational standards and training for the ASM sector, (2) form joint ventures with ASM and LSM interests, and (3) implement stronger environmental safeguards at LSM mines.

First, multiple respondents discussed how ASM workers will need mandatory guidelines that they wear protective equipment when they mine, that such equipment will need protected from theft or corruption, and that such responses need complimented with dust management and mine stability. Expert Respondent 3 warned that *“currently, if you tell ASM teams to wear a face mask and protection, they are unlikely to do it, as it makes their work harder.”* Wearing personal protective equipment (PPE) is often proposed, but was recognized by multiple respondents as being both cumbersome for the operator and largely ineffective. Thus, they suggested that shoring mine shafts would be more effective at preventing fatal accidents than wearing hard hats; preventing dust generation at source is more useful than imposing dust masks (more on this below). As Expert Respondent 3 noted, *“Of course, appropriate PPE (helmets, respirators) are desirable, but should be considered as a second or third line in prevention.”* Expert Respondent 5 added that the DRC desperately needs *“training and skills, especially at mining cooperatives, for local groups and artisanal miners, about workers’ rights and human rights.”* Expert Respondent 12 lastly remarked that *“the government is responsible for giving ASM licenses, so they do have the authority to ensure that miners are adequately trained and supported—mining royalties, which represented more than \$1 billion last year, could be put to better use this way.”* Currently, neither the Mining Code nor DRC regulations offer guidance or enforced safety

standards about the use of gloves, facemasks, work clothes as well as the structural integrity of mines (Amnesty International 2016a; Amnesty International 2018; Lindberg and Andersson 2019).

Second, to help mitigate tension between ASM and LSM interests, our empirical material suggested the government incentivize them to work together. Expert Respondent 21 captured this statement most eloquently, when they noted that:

In my view, a clever solution is to have mining concessions that allow both ASM and LSM. This hybrid approach can work quite well at supporting both types of mining. For instance, ASM miners are incredibly talented at efficiently extracting the best reserves closest to the surface. Because the lead time for any LSM is often very long, at least a year, ASM can commence while LSM preparations are being made. ASM miners can even sell directly to the LSM firm. Then, when LSM commences, it can reach the deposits too deep for ASM miners to reach. A symbiosis of production can occur, with ASM working manually the easily exploitable reserves, and LSM tapping the harder to access reserves. Everybody wins.

Such a strategy would apply the current joint venture approach widely enshrined in the Congolese sector, but not outward towards foreign firms, instead inward towards artisanal mining groups and cooperatives. A strategy of LSM and ASM “coexistence” has already been piloted in at least one other country, Ghana, for gold (Aubynn 2009), although the mining regime there is notably different than the DRC.

Third and lastly, our data suggested the need for stronger safeguards at LSM mines, especially pertaining to mine dust and how security forces and the police treat ASM teams. Expert Respondent 1 emphasized that “*dust is still a major problem both at and on the transit routes to LSM concessions.*” Community Respondent 41 also remarked that “*there is certainly room for improvement when it comes to the environmental performance of LSM sites.*” As a possible sign LSM firms are beginning to take these concerns seriously, ERG (2018) noted that they were implementing better tailings management and reclamation. Rather than leaving tailings scattered around Katanga, they promised to begin reprocessing them at a hydro-metallurgical plant. They also stated a commitment to restoring decontaminated mine sites and to rehabilitate degraded landscapes and watersheds.

6.2 Industrial and foreign mining companies

For industrial operations and foreign mining companies, our data strongly suggested the need for (4) greater benefit sharing with local communities.

Expert Respondent 3 framed the problem as follows:

The bottom line is people don't have or earn enough money for the work they do. Miners but also teachers, nurses, government officials, it's a low-wage and hyper-poor economy. Being poor is much worse for your health than having a little or a lot of cobalt on your plate. The single most damaging effect on health is being poor, the poor live years less than those who are rich. So communities desperately need access to the mining royalties and the possible benefits.

Expert Respondent 2 added that “*given the government is known for corruption, it can easily be bypassed with better or stronger benefit sharing agreements, local taxation, and due process.*” For example, Canada already leads the way with explicitly defined Impact-Benefit Agreements, or IBAs, for mining communities, especially those near indigenous peoples. IBAs ensure that communities surrounding projects benefit from them and are compensated for negative impacts if they occur, especially vulnerable groups and indigenous peoples (O'Reilly and Eacott 1999-2000). Some IBAs even require employment by local people, revenue sharing, reclamation procedures, cross-cultural training, and dispute resolution. For instance, in the Canadian extractive industries sector, IBAs have required the involvement of Inuit businesses and communities in project contracts, established independent review boards, and funded social and educational programs (Impact Benefits Assessment Research Network 2012). One IBA mandates that the Inuit receive \$14 million plus 4.5 percent of mining profits estimated at \$60 million spread over 15 years from a particular mine.

6.3 Artisanal miners and their communities

For ASM communities themselves, especially local chiefs as well as labor and union representative, our data suggests (5) the need for training for alternative livelihoods *not* involved in mining. Expert Respondent 5 framed it this way:

We must move beyond pilots and goodwill. They will be toothless without local leadership to protect artisanal miners. Mining communities and local leaders need to invest in alternative livelihoods, especially agriculture, and local procurement and contracting. They need to create an economy outside of mining.

Community Respondent 39, a miner, even agreed and said that “*if local leaders would retrain us, if we could have responsible and well-paying jobs elsewhere, I would be very interested in learning new skills and opportunities.*” The World Bank (2007) supported this contention when they suggested that local communities focus more on poverty alleviation broadly rather than just mining; that social programs better deliver basic infrastructure; and that local communities diversify so that economies are not so dependent on any single source of income.

To be candid, such alternative livelihoods options are not always easy to pursue or effective by themselves. Perks (2011) for instance noted that smallholder rural agriculture was not always a viable alternative “exit strategy” to artisanal mining, with barriers extending across land access and tenure, skills, and wages. So this study considers it merely one option among many, being perhaps necessary but not fully sufficient.

6.4 Suppliers and manufacturers of electronics

Finally, for suppliers and manufacturers of electronics, our data suggested (6) recognizing the limitations of traceability and ethical minerals schemes, and (7) to not ban ASM cobalt.

Firstly, a great deal of attention has recently focused on fostering transparency and accountability of cobalt mining via traceability or ethical minerals schemes (Hilson et al. 2016). International groups including Amnesty International but also the United Nations and OECD have all called on mining companies to ensure their cobalt is not sourced from mines that involve illegal labor and/or child labor (Katz-Lavigne 2019a).

ERG’s “Clean Cobalt Framework,” launched in 2018, for example announces seven principles or commitments it plans to meet within its supply chain:

- Compliance with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals;
- Ensuring cobalt is free of child labor;
- Requiring that cobalt sources are traceable;
- Affirming that their cobalt does not come from artisanal and small-scale mining;
- Committing to restoring the environment;
- Collaborating to support sustainable community development;
- Supporting the broader industry towards more sustainable cobalt value chains.

First Cobalt (2017) similarly has their “Responsible Cobalt Initiative,” RCS Global has its “Better Cobalt” program, the World Economic Forum (2018) launched a Global Battery Alliance committed to “responsible sourcing” of raw materials for batteries, and one local campaign is even called “*Touche Pas à Mon Cobalt*” (“Don’t Touch My Cobalt”) (Callaway 2018). All of these efforts essentially aim to promote “ethical cobalt” and that “from stone to phone,” metal supply chains must be accountable” (Kara 2018).

Some of the respondents for this study did discuss the utility and desirability of these programs. Expert Respondent 2 remarked that:

Suppliers must promote initiatives like responsible cobalt, which enhance supply chain visibility, accountability and transparency. We need to get children out of mines and into classrooms ... Volkswagen and Tesla are dead scared of having illegal cobalt in their vehicle, they want to be able to pass that risk off to somebody else. So those initiatives become intermediaries who hold the responsibility for authenticating cobalt is clean.

Expert Respondent 10 went further and suggested that such expert certification schemes be done not by individual suppliers, but entire sectors and groups of companies:

At the moment, the leverage or role of any single company is small in terms of its cobalt demand. The role of clean tech firms such as those making cars, batteries, or solar panels is particularly insignificant. The solution is to form coalitions across the entire mining activity, not just whittle away at specific mines or companies. There is no equivalent of a Walmart who have the power to shape supply. There needs to be a multi-mineral, multi-company, and also perhaps multi-technology consortium committed to traceability.

However, Expert Respondent 3 noted such an approach has its limitations and needs implemented with care. As they countered:

In practice, it is extremely hard for green or ethical expert certification schemes to work, especially when traders don’t know where cobalt comes from, in unmarked bags. And, people will hide children when they know inspections or the media are coming, then they reappear when the inspectors leave. Or they all say they are 16

years old, when they are clearly younger. Claims that there is no child labor are incredibly difficult to substantiate.

Expert Respondent 6 added that:

Don't get me wrong, we need to distinguish between good and bad mining companies, but we need nuanced policy, not blunt instruments. My worry is due diligence with supply chains via mining companies and electronics companies will become a technocratic tick the box exercise, putting a tag saying this is clean cobalt, that won't really benefit the local Congolese, won't improve incomes for miners, or led to better labor conditions. Clean cobalt does not for the moment equate to sustainable livelihoods for those who most need income in the Congo.

These comments imply traceability schemes may be impossible to fully enforce in practice, and could in the extreme merely become an exercise in public relations rather than improved governance. Radley and Vogel (2015) raise many of these legitimate critiques with traceability schemes as a whole and the international debate on “conflict minerals.”

Indeed, Vogel et al. (2018) show how already in the DRC, formalization and traceability have not worked when it comes to mining for 3T, where it merely replaced a military monopoly with a financial monopoly. Hilson et al. (2017) similarly showed that formalization in Ghana and Niger did not have a positive or transformative effect on the mining regimes there. In their review of formalization and traceability schemes across all of sub-Saharan Africa, Hilson et al. (2017) warn that such efforts have often resulted in a scarcity of permits awarded, exorbitant costs for miners to legalize their operations, and extremely lengthy and bureaucratic processes for registration. Hinton et al. (2003) add that any strategy of formalization or legalization for ASM must understand that many miners will elect to work outside of a regulatory framework if obvious benefits exist to doing so, and that many miners do not have the resources or skills to participate effectively, including basic literacy.

In tandem with this suggestion, our evidence robustly suggested that global suppliers, and governments, *not* ban ASM mining. Expert Respondent 6 explained that:

Do not assume that all minerals in the Congo have labor rights issues and contribute to conflict. That is a fatal mistake, it is smarter to presume innocent until proven

guilty, let others keep operating. A blanket shutdowns benefit no one, and could do a great deal of harm.

Expert Respondent 3 agreed and said:

It would be a disaster if they made batteries without cobalt for Katanga and the DRC. We must see the cobalt there as an opportunity rather than a curse. Eliminating it from the global supply chain would keep them trapped in perpetual poverty. Sustainability must not come by turning all of the DRC into a victim.

Expert Respondent 22 confirmed when they said “*the last thing you want to do is to stigmatize the source of these metals.*”

Thus, the suggestions above talk about bringing ASM mining into joint ventures with LSM activities and also better implementing safety and health standards. This could be why a consortium of fourteen nongovernmental organizations, including Global Witness and Amnesty International, recently cautioned against the banning of ASM cobalt on the London Metal Exchange (Shabalala and Desa 2019). Faber et al. (2017) even noted that, counterintuitively, banning ASM could actually *increase* child labor by lowering household incomes.

7. Future research directions

Our material lastly led to the identification of five suggestions for future research.

7.1 Examine cocktails rather than single sources of pollution

One suggestion was that studies move beyond studying the pollution and health impacts of isolated cobalt, or even only metals, to other forms of pollution, including radionuclides such as uranium, and other pathways of exposure, including water and food. Community Respondent 2 stated that “*more comprehensive research is needed to look at many environmental outputs, the modeling of multiple pollutants and exposure pathways.*” Expert Respondent 14 explained that “*in order to process cobalt, you need a substantial amount of chemicals, and it is difficult isolating their use, the cocktails they can use. Deformations also occur due to radioactivity in some of the deposits, elevated radioactivity levels, these are not proven yet, we need research to document their extent.*”

7.2 Improve corporate benchmarking and accountability mechanisms

Given that the corporate supply chains with cobalt and its refining tend to be opaque (Amnesty International 2016b), our respondents discussed the need for better corporate

benchmarking to understand which supply chains, especially for LSM, adhere to international standards and those that do not. Expert Respondent 10 explained that:

We don't have good information or data on what happens inside Chinese mines, let alone African mining sites. Interviews are difficult to do, permission is rarely given, trade secrets prevent inquiry, and migrant workers don't want to speak to you out of fear of being fired. It's extremely sensitive politically, like the secret nobody wants to talk about.

Expert Respondent 14 added that:

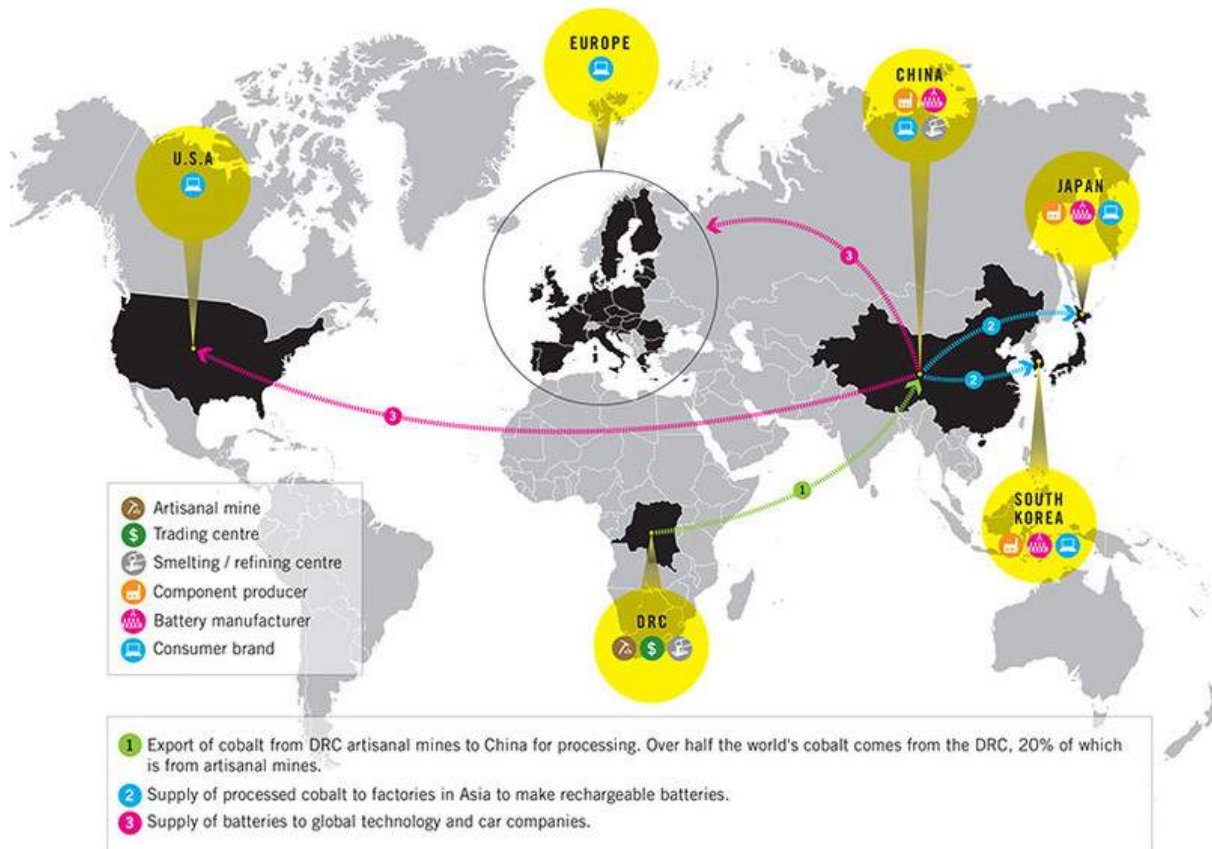
In the industrial sector, there is some transparency, they sometimes work with NGOs who are allowed to go onsite and do human rights studies. At the same time, these Chinese, Indian, and Congolese companies are less concerned with human rights. Research needs to look very carefully from one company next to the other, and also trace joint ventures.

Of particular importance is the relationship between foreign firms, especially those in China, and local Congolese firms and state actors, which need better documented and explored.

7.3 Examine other parts of cobalt's multi-scalar supply chain

This study has focused exclusively on mines, trading depots, and some upstream refining, but that is only a small part of the overall supply chain for cobalt. Banza Lubaba Nkulu et al. (2009) note that other parts, in addition to open pits and underground mines, include washing plants and concentrators, hydrometallurgical plants and smelters for cobalt and copper, which also produce zinc, arsenic, and cadmium as byproducts, and then global refineries where it is converted into cobalt oxide or cobalt sulfate. Rawles (2018) note the chemical processing of cobalt is often done in China, which has 80% of global processing capacity (and that number is rising). Moores et al. (2019) note that from the perspective of particular products, such as batteries, mining is only the *first* stage of the supply chain; the second involves chemical processing and refining, the third cathode or anode production, the fourth battery cell manufacturing. Amnesty International (2016b) tried to map some of the elements of the supply chain for Congolese cobalt and found it involved four separate continents shown in Figure 11.

Figure 11: The complex and multi-scalar supply chain for Congolese cobalt



Source: Amnesty International 2016b.

These other pieces of the supply chain are rarely examined. Expert Respondent 2 affirmed that *“As hard as it is getting data on the mining activities in the DRC, it’s still more available than the knowledge we have on other parts of the cobalt supply chain, especially refining and processing, usually in China. We know little to nothing about the health impacts for workers there, the environmental impacts of acid intensive chemical processing, impact on water and air and climate.”* This statement confirms the necessity of further work examining the whole systems, or multi-scalar, aspects to cobalt’s political economy. Geenen and Cuveelir (2019) aptly identify how the heuristic of a Global Production Network and other spatial lenses can further reveal the scalar complexities of cobalt or other minerals.

7.4 Recognize other vulnerable groups

While this study has demonstrated a collection of vulnerable groups to cobalt mining—including ASM miners, ASM communities, and children—these are not the only ones. Community Respondent 7 for example mentioned that truckers such as them *“drive raw cobalt to South Africa, usually to Durban, through Zambia and Zimbabwe. Along the way, I must always watch for military rebels and robbers across my 2,800 kilometer route, which takes 35 hours if I don’t stop.”*

Given mining is gendered, women are another vulnerable group. Cuvelier (2014, 2017) has conducted ethnographic work with miners in Katanga, and concluded that the act of ASM changes household dynamics so that conspicuous consumption becomes a part of masculine identity, and that significant changes in household gender relations (and spending patterns) result. Rustad et al. (2016) have also shown in the Eastern Congo, community or household proximity to ASM subject women to a greater incidence of sexual violence, with the risk of sexual violence from strangers (non-partners) particularly high for women living close to mines that also have armed guards.

Thus, other possible vulnerable groups beyond miners worth examining include truck drivers transporting cobalt, women and the wives of miners, security guards (caught between LSM and ASM interests), and prostitutes (who were said to frequently visit mining camps). This heterogeneity of vulnerable groups also reminds us that no single community will have the same lived experience with cobalt mining, meaning that vulnerabilities will always be contextual and relational.

7.5 The temporality of mining benefits and risks

Finally, although the benefits and risks of cobalt mining have been presented more inductively and thematically, there is also a temporal dimension that often goes unexamined. Some benefits, and risks, accrue in particular contexts, and their occurrence is dynamic and changes over time. Many of our respondents, for example, noted that the initial benefits of cobalt mining can be seen as “*alluring*” or “*addictive*,” but later give way to displacement and disenfranchisement. Bryceson et al. (2016) confirmed this in their own work on ASM for gold in the DRC, emphasizing the ephemeral nature of benefits. At the beginning, ASM teams are willing to tolerate working in remote, difficult, and dangerous conditions and are motivated to take these risks to “strike it rich.” Nonetheless, as time wears on, the experience with mining becomes starker, with miners coming to acknowledge its challenges and then have to contend with its consequences. Furthermore, Otchia (2019) writes how global commodity prices, especially for copper and cobalt, can strongly affect national and local prices and in turn have significant impacts on trading patterns, exchange rates, and export revenues. As they warn, this means “commodity booms will not last forever” (Otchia 2019: 279). Such temporal issues need better examined and accounted for in future research.

8. Conclusions

To conclude, the political economy of Congolese cobalt is precarious. Artisanal mining operations, vital to the livelihoods of hundreds of thousands of families, are essentially unsafe, ragged holes in the ground, with manual labor, children present, and miners so poor they dig without ladders or tools, some literally by hand. Industrial mines are sophisticated operations similar to strip mining for coal in the United States, with much mechanization and automation, but similarly widespread impacts on the environment, including ubiquitous dust, the pollution of streams and rivers, and the complete relocation of indigenous peoples. Some, like TFM, are massive, with a concession area more than 1,500 square kilometers. Environmentally, tailings reside everywhere, air and water pollution is widespread, and mining dust coats everything, from crops and schools to toys and roads. One respondent compared it to working on “the moon.”

The life of an artisanal cobalt miner is particularly dire. They often spend 12 hours in a mine shaft and work through the night, their bodies ache and they always fear landslides or rockslides. Two spoke of nightmares, more than a dozen spoke of brothers, or friends, that have died in a mine, many also spoke of being beaten, chased, or shot at. ASM miners often develop respiratory diseases, heart diseases, or cancer, and have extremely high levels of toxic metals in their body.

Miners and the communities that they support, tragically, are exploited within this political economy in multiple ways. ASM teams often occupy concession areas that LSM firms own or wish to access, creating tensions that ultimately lead to conflict, protest, theft, violence, and in some situations murder. Women and young children are present across mining communities and often entrapped or victimized. ASM miners have no safeguards with respect to their health or security, and they are also subjected frequently to corrupt and extortionist mining police, local political officials, or national officials including the Republican Guard. Even traders and middlemen are reputed to charge usurious rates or undervalue the market price of cobalt. The extent of the trading, processing, sorting, and refining operations is extensive, with more than 200 “depots” for collecting the cobalt and copper witnessed by the author. This job, even though it may exploit the diggers, is almost as tough: hauling around sacks weighing 60 to 90 kilograms, then sorting the deposits and manually crushing them with hammers. These workers also spoke of health problems, fatigue, and being cheated out of fair wages. Even the exploiters of diggers are exploited by

someone else, and this is in a province known for being perhaps the “best governed” in the entire country.

These calamities with cobalt are a sharp contrast to the clean, shiny electronic products that depend on the very cobalt being mined. And for that, the consumers and users of a digital society are at least partially responsible, given that cobalt exists within a complex multi-scalar political economy involving local communities, national governments, and global technology suppliers. As part of this system, we all share the some of the blame, with our insatiable demand for electronic products and a society addicted to digital technology.

Because of this political economy, it is likely the future of cobalt will remain contested and conflicted. Someone stands to lose if cobalt mining patterns move in any direction: greater amounts of ASM will involve more children and women, more accidents and landslides, strengthened dependence on mining as a source of income, and deepened devastation local ecosystems. However, fewer amounts will result in unemployment and choke off what little state revenue trickles down to communities already scarred by decades of chronic poverty, corruption, war, and conflict, with many of the most affected people orphans or former refugees. Put another way, Congolese cobalt operates within a complicated political economy where any attempt to reform livelihoods, manage practices, or govern supply chains will alter power dynamics in ways that may only entrench some degree unsustainability or inequality. If it is, as one of our respondents stated, akin to a “*third Congolese war*,” it is a low-intensity conflict with chronically occurring impacts. Or as Community Respondent 2 summarized, “*cobalt mining contributes to a constant tension between communities relocated and those that are not, between artisanal mining and industrial mining, between the rich in three story houses and those living in abject poverty in huts. Cobalt means conflict.*” Perhaps perversely, the more extensively embedded cobalt mining becomes to livelihood and identity in the DRC, the more exposed communities also become to its risk.

There is, nonetheless, a promising pathway forward, with this study identifying seven interrelated policy suggestions that would improve the sustainability and governance of cobalt mining. Enforcing better occupational standards for ASM miners would mitigate the risk of landfills and accidents, and the forming of joint ventures with ASM and LSM interests would ease tensions between the two groups. Better environmental management and reclamation at LSM mines would improve community health, and broader and more robust

community benefit sharing agreements would ensure the Congolese themselves benefit more directly from mining. Mining communities can diversify away from mining to support training for alternative livelihoods. Transnational suppliers of electronics goods can also come to recognize the limitations of traceability schemes, and to value and accept ASM cobalt. The implication here is that improving the political economy of cobalt is a multidimensional and multi-institutional process. Perhaps most of all, it underscores the necessity of a diffuse chain of actors—including governments, technology firms, and consumers—accepting their own responsibility in the plight of the Congolese people.

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10. Appendix 1 Registered Mining Companies in the DRC

Domestic mining companies

- Africa Smelting Corporation Sprl
- Amani Consulting Sprl
- Austral Africa Resources Ltd
- Boboko Investment Pte Ltd
- Congo Cobalt Corporation
- Congo Dongfang International Mining Sprl
- Congo Mineral Resources Sprl
- Congo Mining Co. Sprl
- Diamond Industry Associates Ltd
- Exploitation Artisanale Du Congo Sprl
- Kasai Wa Balengela/ Tshiamalamuikila
- Margaux Sprl
- Mine De Kawama
- Mine De Likulu Kisenge
- Minière de Bakwanga Sarl
- Mining Company Katanga Trucks Sprl
- Mining Mineral Resources Sprl
- Namakwa Diamonds Ltd
- New Stone Mining Sprl
- Nucoco Sprl
- Pangimines Sprl

- Phoenix Mining Corporation Sprl
- Rubamin Sprl
- Shituru Mining Corporation Sprl
- Slag Treatment Plant Lubumbashi
- Société Minière de Kilo-Moto Sarl
- Sojofils Mining (Pty) Ltd
- Somika Sprl
- TSM Enterprise Sprl

Foreign mining companies

- Glencore (Mutanda Mining Sprl, Katanga Mining Ltd)
- Camrose Resources
- Katanga Minerals
- Premiere Miniere Du Katanga
- Anvil Mining Congo Sarl
- Benzu Resources Ltd
- Camrose Resources Ltd
- Chemaf Sprl
- Compagnie Minière du Sud Katanga Sprl
- Congo Minerals Sprl
- Frontier Sprl
- Groupe George Forrest Internationale Afrique Sprl
- Jindal DRC Sprl
- Katanga Minerals Processing
- Kibali Goldmines Sprl
- Kolwezi Investments Ltd, Frontier Sprl
- La Compagnie minière de Sakania Sprl
- Loncor Resources Inc (Prior to Acquisition by Nevada Bob's International Inc)
- Luisha Mining Enterprise Sprl
- Miniere Musoshi Kinsenda
- Mining and Processing Congo Sprl

- New Congo Resources Development Company Inc
- Pangimines Sprl
- Premiere Miniere Du Katanga
- RAK Minerals & Metals Congo FZ - LLC
- Roan Prospecting & Mining Sprl
- Rockbury Properties Ltd
- Ruashi Mining Sprl
- Shamika Resources, Inc
- Société Minière de Kolwezi Sprl
- Tenke Fungurume Mining Sprl